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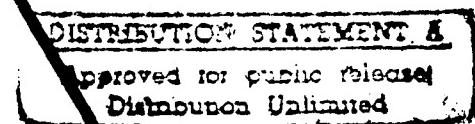


Monitoring Well Construction and Groundwater Quality Analysis at the U.S. Army Reserve Center Complex and Training Area-84th Division

Milwaukee, Wisconsin

Contract No. DACA45-87-D-0075
Project No. HA01005-8P

March 1989



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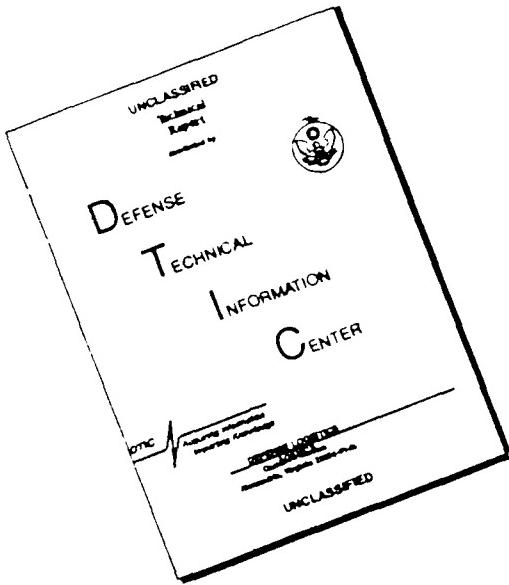
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Donohue

March 29, 1989

Commander Fort McCoy
AFZR-DE-E
Sparta, WI 54656

Attn: Colonel Westenburg
Director of Directorate of Engineering

Re: Monitoring Well Construction and Groundwater Quality Analysis
US Army Reserve Center (U.S.A.R.C.) Complex and Training Area
Milwaukee, Wisconsin
Donohue Project No. 15977.007

Dear Colonel Westenburg:

Donohue & Associates is pleased to submit to your attention ten (10) copies of our final report entitled "Monitoring Well Construction and Groundwater Quality Analysis at the U.S. Army Reserve Center Complex and Training Area-84th Division, Milwaukee, Wisconsin" (March, 1989). This work was performed under Contract No. DACA45-87-D-0075, Project No. HA01005-8P.

The attached report discusses geologic, hydrogeologic and water quality information obtained during this (and other) investigations conducted at the U.S.A.R.C. Complex. Results of this study indicate that groundwater quality has been impacted at several monitoring locations across the U.S.A.R.C. site by selected indicator, public health and public welfare parameters, including volatile organic compounds. However, the hydrogeologic information obtained during this investigation indicates that the observed impact has resulted from off-site sources located northeast (upgradient) of the U.S.A.R.C. site.

Please feel free to contact Donohue should you have any questions or comments regarding this report.

Very truly yours,

DONOHUE & ASSOCIATES, INC.

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MONITORING WELL CONSTRUCTION
AND GROUNDWATER QUALITY ANALYSIS

AT THE

U.S. ARMY RESERVE CENTER COMPLEX AND TRAINING AREA
84TH DIVISION
MILWAUKEE, WISCONSIN

Contract No. DACA45-87-D-0075
Project No. HA01005-8P

March, 1989

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Donohue & Associates, Inc.
4538 North 40th Street
Sheboygan, WI 53083

Project No. 15977.007

I David S. Voight certify that I
am a hydrogeologist and meet or exceed
the requirements of NR.500.03(64) of the
Wisconsin Administrative Code.

I Joel R. Giraud certify that I
am a hydrogeologist and meet or exceed
the requirements of NR.500.03(64) of
the Wisconsin Administrative Code.

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Attachment

- 1 Department of Army Request for Proposal and Scope of Services

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- A Donohue Boring Logs
- B Twin City Testing Boring Logs
- C Donohue Well Construction Diagrams
- D Twin City Testing Well Construction Diagrams
- E Well Development Forms
- F Groundwater Sampling Results
- G Wisconsin DNR Groundwater Monitoring Well Installation Form

RP/USARMY/M/AA5

1.0 INTRODUCTION

During September, 1988, Donohue & Associates, Inc., received by authorization from the U.S. Department of the Army to proceed on Open-End Contract No. DACA45-87-D-0075 for Monitoring Well Construction and Groundwater Analysis, Milwaukee, Wisconsin (Project No. HA01005-8P). This project was completed in accordance with the Scope of Services presented in the August (1988) U.S. Army Request for Proposal (RFP), except for those deviations noted elsewhere in this report. For reference, a copy of the RFP has been included in this report (Attachment 1). All work activities associated with this project were conducted under the jurisdiction of the Commander, Fort McCoy, Wisconsin.

The purpose of this field investigation was to determine the geologic and hydrogeologic characteristics at the U.S. Army Reserve Center Complex and Training Center (U.S.A.R.C.) in Milwaukee, and to assess current groundwater quality at this site. These objectives were accomplished by (1) reviewing existing monitoring data compiled from previous investigations conducted at the U.S.A.R.C.; (2) installing additional groundwater monitoring wells; (3) collecting bimonthly water elevation data; and (4) performing two monthly groundwater sampling events.

This report presents our project approach, regional and site-specific information obtained during this and earlier investigations, and provides the Department of the Army with information pertaining to groundwater quality. This includes documentation of well construction methods and groundwater sampling protocols employed during this investigation. In addition, historic hydrogeologic and water chemistry data has been compiled to determine whether groundwater contamination currently exists at this site, and to assess the extent of any observed contamination.

1.1 General Location and Topography

The U.S.A.R.C. study area is located between North 48th and North 55th Streets in the City of Milwaukee (Figure 1). This property lies adjacent to, and directly north of, West Silver Spring Drive. The U.S.A.R.C. is bounded on the northeast by the Chicago, Milwaukee, St. Paul, and Pacific Railroad right-of-way.

Surface topography at the site is represented by nearly level, to very gently rolling terrain with a maximum 25-foot difference in relief (Figure 2). The lowest elevation (approximately 670 feet above mean sea level) occurs at Lincoln Creek in the southwestern portion of the study area. The highest elevations (approximately 695 feet above mean sea level) are in the northernmost part of the U.S.A.R.C., and along the northeast boundary of the study area. Surface slope is directed towards the southwest.

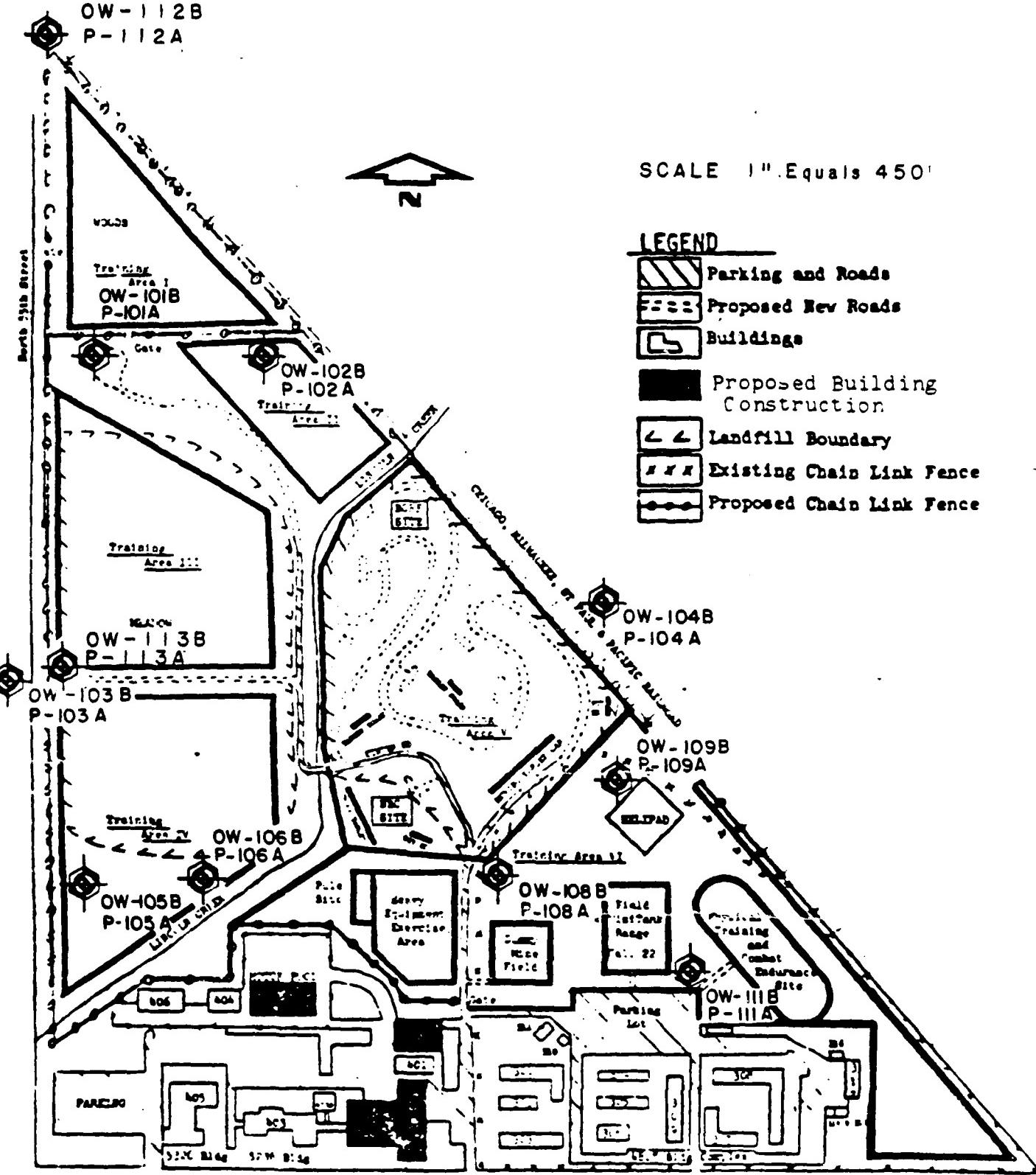


FIGURE I
LOCATION OF WELLS
MILWAUKEE U.S.A.R. CENTER
COMPLEX AND TRAINING AREA
MILWAUKEE, WISCONSIN
DONOHUE & ASSOCIATES
1989

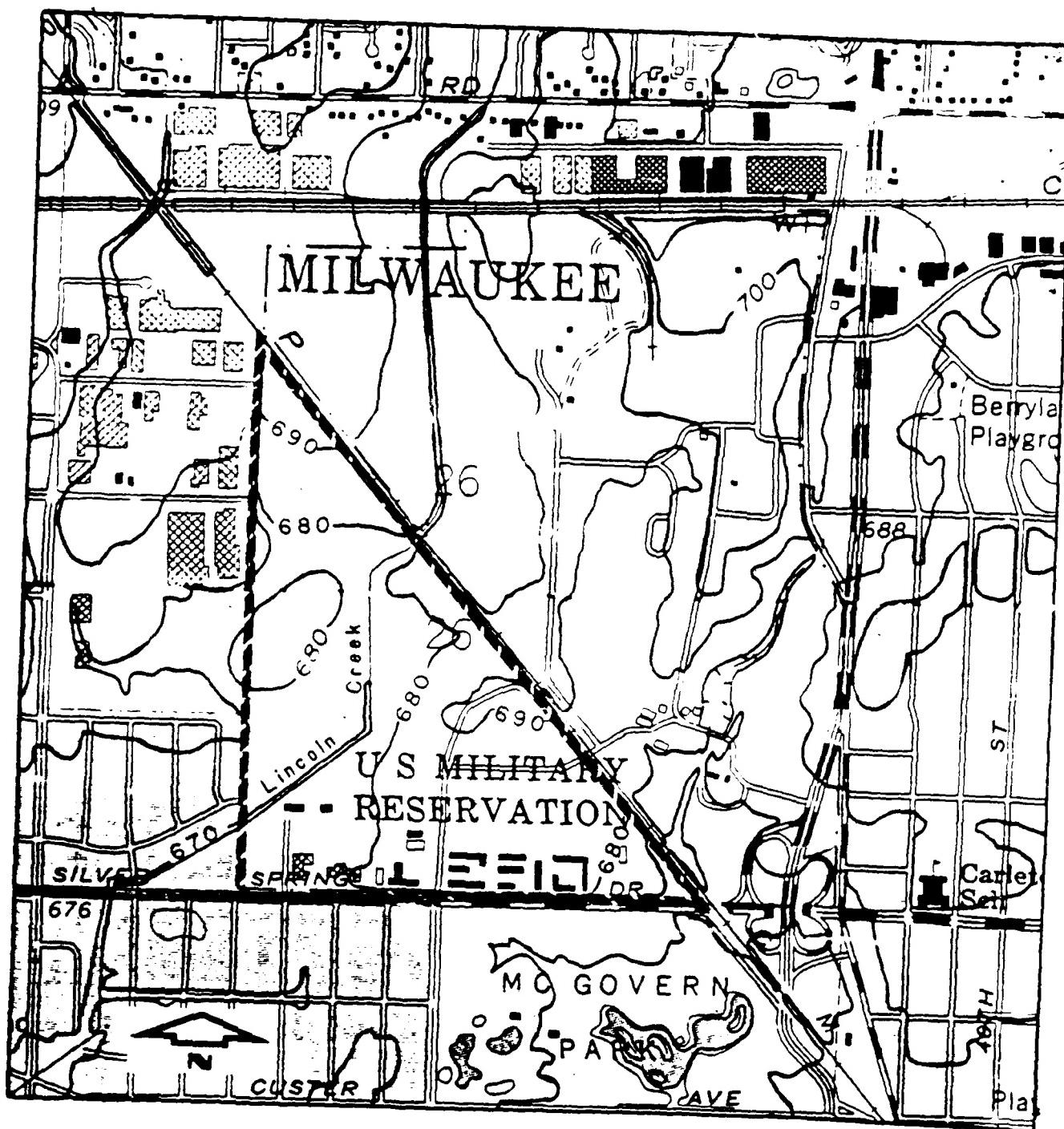


FIGURE 2
TOPOGRAPHIC MAP
MILWAUKEE U.S.A.R. CENTER
COMPLEX AND TRAINING AREA
MILWAUKEE, WISCONSIN
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1989

Lincoln Creek bisects the western portion of the U.S.A.R.C., flowing southward across the study area. Surface water drainage across the site is directed to the south-southwest towards Lincoln Creek. Lincoln Creek originates approximately 2 miles northwest of the U.S.A.R.C. complex, and discharges into the Milwaukee River, approximately 2.5 miles southeast of the study area. The southwest portion of the U.S.A.R.C. complex is located within the Lincoln Creek 100-year floodplain.

1.2 Present and Prior Land Uses

The U.S.A.R.C. is comprised of several administrative/maintenance buildings located on approximately 60 acres (Figure 1). The complex includes military reserve buildings, a motor repair shop, paved roadways, parking areas, and sidewalks. The entire facility is fenced, and access onto the site is restricted.

Adjacent land use consists of mixed light-commercial and residential areas north of the U.S.A.R.C.; the Chicago, Milwaukee, St. Paul and Pacific Railroad right-of-way and the Havenwoods Nature Center on the east; residential and recreational (McGovern Park) areas to the south; and residential and light-commercial use along 55th Street, and areas further west (Figure 2).

Prior land use information presented within the "Environmental Assessment and Finding of No Significant Impact Report" prepared in 1984 indicates that landfilling operations occurred at the U.S.A.R.C. between 1957 through 1966. Reportedly, the Milwaukee Sanitation Department disposed of approximately 500,000 cubic yards of solid waste at this site. This included furniture, appliances, street sweepings, leaves, tin cans, bottles, ashes, cinder and sewer pipe. No newspaper, garbage, industrial or hazardous waste was accepted. During landfilling operations, earth berms were constructed to minimize the flow of potential contaminants to Lincoln Creek.

Samples of seepage discharge collected by the Wisconsin DNR in 1983 indicated that the discharge did not contain pollution concentrations that would be detrimental to public health, wildlife, fish, or aquatic life. Samples of Lincoln Creek collected by the DNR in 1983 at stations located upstream and downstream of the landfill cells also indicated no contamination (Department of the Army, 1984).

1.3 Background Information

Geologic, hydrogeologic and water quality information obtained during previous studies conducted by Donohue and Foth & Van Dyke at the U.S.A.R.C. has been reviewed and is summarized in the following section of this report.

Donohue, 1985

In 1984, Donohue was retained by the U.S. Army Corps of Engineers (Omaha) to define site geology and hydrogeology, and to determine the potential impact the landfill exerted on soil and groundwater quality. This was accomplished by installing eighteen nested groundwater monitoring wells at nine locations across the site, and initiating a groundwater sampling program. The results of this investigation are summarized in a report entitled, "Landfill Impact Evaluation, USAR Center Complex and Training Area" (April, 1985).

Boring information obtained by Donohue in 1985, demonstrated that a bedrock "high" occurs in the southeast portion of the site (27-foot depth). Bedrock is overlain by unconsolidated glacial drift. Lithologically, the drift is comprised of clayey-silt, silty-sand, and sand and gravel layers.

Water level information obtained in the 1985 Donohue study suggested that a water table "high" was located in the south-central portion of the site at that time. Local groundwater flow in the area of the mound was expected to be directed laterally (and downward) towards the east, west, and north. Groundwater movement in other areas of the study area were anticipated to be directed primarily towards the south and southwest. Groundwater gradients obtained during this study indicate that groundwater recharge occurring across the site moves within the shallow water table system, discharging into Lincoln Creek.

Groundwater and surface water chemistry data obtained during this earlier study indicated that higher than expected concentrations of chloride, sulfate, Total Dissolved Solids, and hardness occurred in selected wells. Although the concentration of compounds observed indicated that potential impact from the landfill may have occurred, it was also possible that the contaminants observed were derived from off-site, (upgradient) sources. These possibilities could not be fully-addressed due to the design of the monitoring program in place at that time.

Foth & Van Dyke, 1988

A second study discussing landfill cap design, site hydrogeology, and groundwater quality data was conducted at the U.S.A.R.C. by Foth & Van Dyke and Associates. The results of this investigation have been summarized in a report entitled, "Landfill Sampling and Analyses, U.S.A.R.C., West Silver Spring Driv., Milwaukee, Wisconsin (February, 1988)". During February 1987, eighty-seven auger borings were drilled at 200-foot intervals through the landfill cap to document clay content and cap thickness. This study revealed that approximately 75 percent of the

landfill site had been capped by less than 2 feet of clay. This indicates that a large portion of the site does not satisfy landfill closure requirements as stipulated in the Wisconsin Administrative Code.

A water table map for this site was prepared by Foth & Van Dyke using water elevation data obtained September 28, 1987. This information indicated that a water table "high" was located in the south-central portion of the study area. Local groundwater flow near the water table mound was shown as being directed towards the northeast and west, while groundwater movement in other areas of the site is to the west and southwest. These results are comparable with those presented in the 1985 Donohue report.

Water quality data obtained by Foth & Van Dyke indicate that surface water and groundwater at the site were impacted at that time. Five wells exceeded the Wisconsin DNR Preventative Action Limit (PAL) for vinyl chloride. Four wells containing this contaminant were located upgradient (north) of the site. Other organic constituents detected, but which did not exceed the PAL, were 1,1 dichloroethane (upgradient), 1,2 dichloroethylene (upgradient), trichloroethylene (upgradient), tetrachloroethylene (downgradient), and toluene (downgradient). Chloroform and dichlorobromomethane were observed in surface water samples collected from Lincoln Creek (upstream, downstream).

Inorganic analytes detected in groundwater samples collected by Foth & Van Dyke, which exceeded the established PAL, included chloride, arsenic, cadmium, iron, and sulfate. High chloride and iron concentrations were observed in upgradient wells suggesting an off-site source. Sulfate exceedances were observed in many locations across the study area.

The water quality information given in the Foth & Van Dyke study indicated that the groundwater at the site had been impacted. Foth & Van Dyke staff also concluded that a source other than the landfill may be responsible for the vinyl chloride observed in the groundwater. It was recommended that additional wells be installed to further define hydrogeologic characteristics of this site, and to obtain additional information necessary to assess whether the observed groundwater contamination was due to off-site sources.

RP/USARMY/M/AAS

2.0 PROJECT APPROACH

The previous groundwater investigation conducted by Foth & Van Dyke has demonstrated that volatile organics and other indicator parameters (including vinyl chloride) were present in some of the monitoring wells located upgradient of the landfill area. The current expanded monitoring well installation and groundwater sampling program conducted at the USARC by Donohue was performed to obtain additional hydrogeologic and water chemistry information. This information has been used to define the aerial extent of any observed contamination, and to determine whether the contaminants are derived from on-site or off-site sources.

2.1 Scope of Services

Donohue satisfied the above objectives by completing the following Scope of Services:

1. Background information obtained by Donohue (1985) and Foth & Van Dyke (1988) was reviewed to determine prior site history, and to provide information useful for the completion of this project.
2. Donohue prepared a site-specific workplan (November 1988) specifying well construction and groundwater sampling protocols, data quality objectives, and health and safety procedures.
3. Donohue prepared technical specifications for soil boring, well construction and other related activities, and entered into an agreement with Twin City Testing Corporation (Wausau, Wisconsin).
4. Two well nests, each consisting of a water table observation well and an adjacent piezometer, were constructed of 2-inch, flush-joint stainless steel riser and screen at locations determined by the Department of the Army.
5. Two rounds of water quality sampling for volatile organics were performed (GC/MS) for each new well, as well as selected pre-existing wells. The wells sampled during December, 1988, and January, 1989, included:

P-101A/OW-101B	P-106A/OW-106B
P-102A/OW-102B	P-112A/OW-112B (new wells)
P-105A/OW-105B	P-113A/OW-113B (new wells)

6. Groundwater samples collected from each newly-installed well during December, 1988, and January, 1989, were also analyzed for the following:

- a. Field parameters including temperature, pH, color, odor, turbidity, and specific conductance.
 - b. Dissolved metals including iron, barium, chromium, mercury, lead, cadmium, and arsenic.
 - c. Indicator parameters including COD, BOD, hardness, odor alkalinity, nitrogen (plus nitrate), chloride, sulfate, and boron.
7. Water level measurements were collected bimonthly from each of the above wells during December, 1988, and January, 1989.
 8. All wells were surveyed, referencing their vertical and horizontal locations to a USGS bench mark (or the Wisconsin State Plane Coordinate System).
 9. Donohue completed Wisconsin DNR Well Installation Forms documenting well construction details.

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3.0 REGIONAL GEOLOGY AND HYDROGEOLOGY

3.1 Stratigraphy

The U.S. Army Reserve Center Complex and Training Area is underlain by soils which have been disturbed in many areas due to landfilling and other site development activities. On-soils have been assigned to the Loamy Land, Ashkum, Clayey Land, Mequon, and Ozaukee Soil Series.

Variable thickness of Wisconsinan-Age glacial drift underlie the surficial soil. Two till units have been mapped by the Wisconsin Geologic and Natural History Survey across the region. The uppermost sequence of fine-grained till, lacustrine clay, silt and sand, and glaciofluvial sand and gravel deposits have been assigned to the Oak Creek Till. This unit is underlain by noticeably coarser till deposits, comprised predominantly of silty and clayey sands and gravels (New Berlin Till). The glacial drift is unconformably underlain by the Niagara Dolomite of Silurian age.

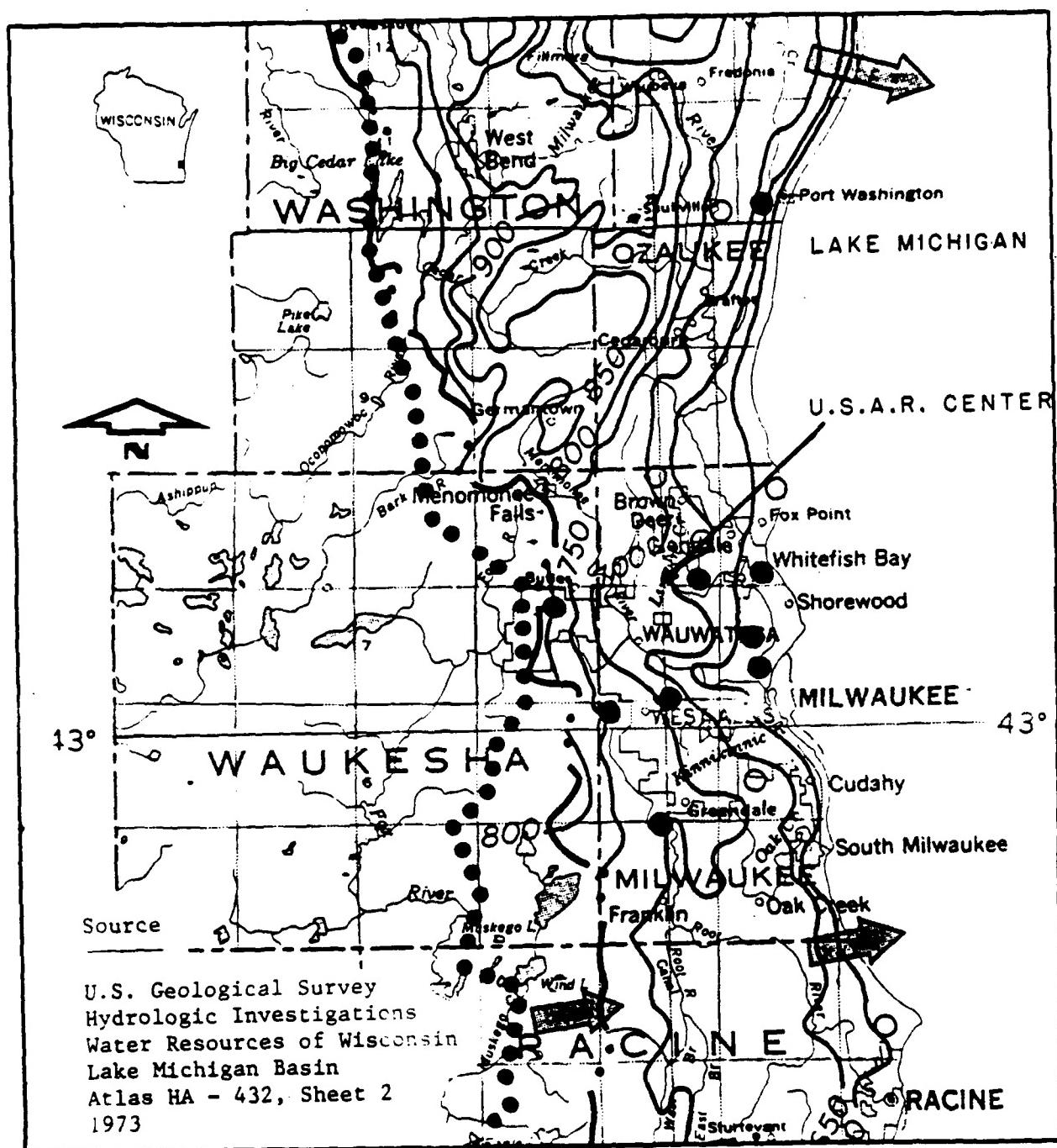
3.2 Hydrogeology

Published hydrogeologic information has documented the existence of two main aquifer units in Milwaukee County. Throughout much of the region, the shallow water table (unconfined) aquifer is comprised of the unconsolidated glacial drift unit, which is hydraulically connected with the underlying Niagara Dolomite. Lithologic differences in the drift unit may locally inhibit hydraulic connection between these two hydrologic units. Generally, small to moderate groundwater supplies are obtained from the water table aquifer. Well yields are dependant on grain size, sorting, and the saturated thickness of sediment comprising the glacial unit, and the presence of fractures, joints, solution channels in the Niagara.

Recharge to the unconfined drift and Niagara aquifer system results primarily from downward seepage of precipitation. Locally, the groundwater discharges to wells, streams, lakes, wetlands, and Lake Michigan.

The deep, confined Cambro-Ordovician sandstone aquifer is the dominant source of groundwater for Milwaukee County. Moderate to large quantities of good quality water are obtained from this aquifer. Wells fully-penetrating this aquifer are capable of producing from 1000-2000 gallons per minute. Well yields are affected by the thickness of aquifer penetrated, and the amount of permeability and porosity development.

Figure 3 is a regional water table map which shows water table elevation data, and general groundwater flow direction in the unconfined drift and Niagara aquifer system in the vicinity of



Scale

1" Equals 8 Miles

Legend

- Groundwater Divide
- 700— Water Table Contour
- Groundwater Flow Direction
- Observation Wells

FIGURE 3
REGIONAL WATER TABLE MAP
MILWAUKEE U.S.A.R. CENTER
COMPLEX AND TRAINING AREA
MILWAUKEE, WISCONSIN
DONOHUE & ASSOCIATES
1989

the U.S.A.R.C. Since groundwater flow in the water table system (indicated by arrows) is from areas of high hydraulic head to areas of lower head, groundwater movement appears to be directed primarily towards the east and southeast. Local groundwater flow within the water table system is anticipated to be interconnected with Lincoln Creek which flows south of the site. Groundwater movement within the deep, confined aquifer system is directed eastward, towards Lake Michigan.

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4.0 SUBSURFACE FIELD INVESTIGATION

The various work tasks comprising this program were generally completed in accordance with the site-specific workplan prepared by Donohue entitled, "Monitoring Well Installation and Ground-water Sampling and Analysis Plan (November 1988)". Health and Safety procedures and technical specifications used during this project have been included in the project workplan.

4.1 Well Locations

Two well nests, each comprised of an observation well and an adjacent piezometer, were installed from November 14-28, 1988, at the U.S.A.R.C. to obtain additional hydrogeologic and water quality data. The general locations of wells OW-112B/P-112A, and OW-113B/P-113A were determined by the Department of the Army prior to initiation of the well installation program.

As shown in Figure 1, well nest OW-112B/P-112A was installed approximately 5 feet outside the extreme northern limit of the U.S.A.R.C. complex. Installation of wells within the fenced area was not possible because the area was heavily wooded, and would have required the removal of several trees, brush, or a portion of the fence. To preclude such activities, the Department of the Army located the well nest just north of the fenced area. To reduce the potential for vandalism, each well at this location was constructed with locked, protective casings and flushed-mounted covers. Well nest OW-113B/P-113A was installed on U.S.A.R.C. property, approximately 30 feet east of the Reserve Center fence, and east of the driveway (trail) located immediately along the fence.

4.2 Well Installation Procedures

Borings were drilled in the unconsolidated surficial deposits using a 4 1/4-inch I.D. hollow stem auger. Standard split spoon samples were taken at 5-foot depth intervals. Soil boring, soil sampling and well construction activities were continuously monitored by a Donohue geologist or hydrogeologist. Continuous monitoring of air quality in the vicinity of each borehole was performed as drilling proceeded. Boring logs prepared by Donohue and Twin City Testing are included in Appendices A and B respectively. Well construction diagrams appear in Appendices C and D.

Historic well construction information pertaining to all wells installed at this site has been summarized in Table 1. Well construction information for each newly-installed well is summarized on a Wisconsin DNR Groundwater Monitoring Well Installation Form, Form 4400-89 (Appendix G).

TABLE I
WELL CONSTRUCTION INFORMATION
U.S.A.R.C., Milwaukee

Well No.	Well Type	Well Status	Install. Date	Ground Elev (ft)	Top/PVC Elev (ft)	Well Depth (ft)	Screened Interval (ft)	Lithology At Screen
1) OW-101B	Observ. Well	Active	11/84	-	686.89	20	10-20	CL-ML, GW
2) P-101A	Piezometer	Active	10/84	-	686.86	46	41-46	SM
3) OW-102B	Observ. Well	Active	11/84	-	686.04	20	10-20	GW
4) P-102A	Piezometer	Active	10/84	-	685.99	45	40-45	CL-ML, SM
5) OW-103B	Observ. Well	Abandoned	10/84	-	681.18	20	10-20	GW, ML-CL
6) P-103A	Piezometer	Abandoned	11/84	-	681.98	45	40-45	ML-CL, SM
7) OW-104B	Observ. Well	Active	10/84	-	691.98	20	10-20	SM, CL-ML
8) P-104A	Piezometer	Active	11/84	-	692.11	38.3	33.3-38.3	ML-CL
9) OW-105B	Observ. Well	Active	11/84	-	677.28	20	10-20	CL-ML
10) P-105A	Piezometer	Active	11/84	-	677.43	45	40-45	ML-CL, GW
11) OW-106B	Observ. Well	Active	11/84	-	677.07	20	10-20	CL-ML, SM
12) P-106A	Piezometer	Active	10/84	-	677.02	45	40-45	ML-CL
13) OW-107B	Observ. Well	Inactive	11/84	-	-	-	-	-
14) P-107A	Piezometer	Inactive	11/84	-	-	-	-	-
15) OW-108B	Observ. Well	Active	11/84	-	696.58	15	10-20	ML, SM
16) P-108A	Piezometer	Active	11/84	-	696.48	42	37-42	Limestone
17) OW-109B	Observ. Well	Active	10/84	-	694.99	20	10-20	ML, ML-CL
18) P-109A	Piezometer	Active	11/84	-	694.88	36	31-36	Limestone
19) OW-111B	Observ. Well	Active	10/84	-	690.93	20	10-20	SM-ML, SM
20) P-111A	Piezometer	Active	10/84	-	690.97	38.5	33.5-38.5	ML-CL
21) OW-112B	Observ. Well	Active	11/88	691.54	691.36	25.1	15.1-25.1	CL, SM
22) P-112A	Piezometer	Active	11/88	691.76	691.22	44.4	39.4-44.4	GW, CL
23) OW-113B	Observ. Well	Active	11/88	679.94	682.94	18.0	7.8-18.0	CL, SM
24) P-113A	Piezometer	Active	11/88	679.98	682.98	44.0	39.0-44.0	CL, SP

¹Depth measured from ground surface during well installation.

Wisconsin State Plane Coordinates for all wells installed at the U.S. Army Reserve Complex are presented in Table 1a. This table includes top of riser pipe elevations.

4.2.1 Well Nest OW-112B/P-112A

Observation Well (OW-112B)

On November 16, 1988, a boring was drilled for observation well OW-112B. Split-spoon samples were obtained from the boring at depths of 10, 15, and 20 feet during drilling operations. Total boring depth was 25 feet. Installation of this well was initiated by placing a 10-foot stainless steel screen and riser in the borehole. This activity was followed by the placement of filter pack sand in the well annulus. However, during measurement of the filter pack, a foot-long metal rod attached to the end of the measuring tape became stuck. Subsequent activities resulted in breaking off the tape in the well at a depth of approximately 16 to 17 feet below the ground surface necessitating abandonment. Following removal of the well screen and casing, the boring was backfilled with a cement/bentonite grout as specified in the Wisconsin Administrative Code.

On November 17, 1988, another boring was drilled for OW-112B at a location approximately 4.5 feet northwest of the abandoned borehole. This boring was drilled to a depth of 25.3 feet. The geologic strata encountered consisted of a sequence of clay, silt, sand, and gravel layers, and mixtures of the same.

A 2-inch (I.D.) stainless steel screen, with 0.010-inch openings was placed from a depth of 15 to 25 feet. A 2-inch (I.D.) stainless steel casing was placed from 6 inches below the ground surface to a depth of 15 feet in the well annulus.

Red flint filter pack sand (No. 30) was placed in the annular space between the well screen, casing, and native formation from a depth of 9.5 feet to 25.3 feet. The native formation in the screened interval was comprised of clay, silty, gravelly sand, and sandy to gravelly clay.

A 3-foot thick bentonite seal was placed above the filter pack and 0.5 feet of sand was placed above the bentonite seal. A 4-inch diameter, 5-foot long protective steel casing was placed over the observation well riser. The top of the protective casing was placed approximately 2 inches below the ground surface. A 5.8-foot thick concrete collar was placed in the annulus above the filter pack, to a depth of approximately 9 inches below the surface. Approximately 3 inches of sand was placed above the concrete collar. A flush-mount cover was placed over the protective casing and set into the concrete collar. Well construction was completed by sloping the concrete gently away from the flush mount cover to direct surface water drainage away from the well.

TABLE 1a
 MONITORING WELL LOCATIONS AND ELEVATIONS
 WISCONSIN STATE PLANE COORDINATE SYSTEM
 SOUTH ZONE

<u>Well No.</u>	<u>Y Value</u>	<u>X Value</u>	<u>Elevation*</u> <u>(NVD 1929)</u>
OW101	417,120.9	2,539,200.1	686.89
P101	417,122.9	2,539,195.3	686.86
OW102	417,114.4	2,539,732.2	686.04
P102	417,113.1	2,539,738.2	685.99
OW103	415,878.8	2,538,943.5	681.18
P103	415,879.8	2,538,946.4	681.98
OW104	416,344.7	2,540,766.0	691.98
P104	416,341.5	2,540,761.6	692.11
OW105	415,395.9	2,539,101.0	677.28
P105	415,392.3	2,539,100.6	677.43
OW106	415,405.4	2,539,464.0	677.07
P106	415,408.5	2,539,462.7	677.02
OW108	415,740.9	2,540,544.3	696.58
P108	415,733.8	2,540,540.4	696.48
OW109	415,810.7	2,540,797.2	694.99
P109	415,814.4	2,540,793.9	694.88
OW111	415,375.6	2,541,016.9	690.93
P111	415,372.3	2,541,016.7	690.97
P112A	418,021.4	2,539,211.5	691.76
OW112B	418,017.3	2,539,210.0	691.54
P113A	415,872.9	2,539,072.3	679.98
OW113B	415,877.9	2,539,068.3	679.94

*Elevation of top of PVC riser, referencing the 1929 National Vertical Datum.

Piezometer (P-112A)

Soil boring and soil sampling activities for boring B-112A were completed on November 22, 1988. Construction of piezometer P-112A was completed on November 23.

This boring was drilled to a depth of 45.5 feet before encountering refusal (bedrock?). An attempt was made to obtain a sample at the total boring depth with a split-spoon sampler. No sample was retrieved, however. The geologic strata encountered in this boring consisted of interbedded layers of clay, silt, sand, gravel, and mixtures of the same.

Two-inch (I.D.) stainless steel screen with 0.010-inch openings was placed from a depth of 39.4 feet to 44.4 feet.

Red flint filter pack sand (No. 30) was placed in the annular space between the well screen, casing, and native formation from a depth of 33.8 feet to 44.4 feet. The native formation in the screened interval was comprised of sandy gravel, gravelly sand, and silty clay.

An attempt was made to place a bentonite pellet seal above the filter pack. However, when the augers were pulled up slightly above the filter pack to allow space for placing bentonite pellets, formation material upwelled in the auger. Approximately 50 gallons of water obtained from U.S.A.R.C. Building 312 was used to remove the material. Over time, unconsolidated soil materials again slowly upwelled inside the auger. After refushing the auger with an additional 50 gallons of water, a bentonite-sand slurry was tremied inside the auger from a depth of 33.8 feet, to a depth of 8 feet.

A 3-foot thick bentonite seal was placed above the bentonite-sand grout backfill. A 4-inch diameter steel protective casing was placed over the observation well casing. The top of the protective casing was set approximately 2 inches below the ground surface. A flush-mount cover was placed over the protective casing, and a 6-foot thick concrete collar was placed in the annular space between the protective casing flush mount cover and native formation. The concrete collar was sloped gently away from the cover to facilitate surface water drainage.

4.2.2 Well Nest OW-113B/P-113A

Observation Well (OW-113B)

Soil boring and sampling activities were completed at boring B-113B on November 14, 1988. Observation well OW-113B was constructed in this boring on November 15.

This boring was drilled to a depth of 20 feet. The geologic strata encountered consisted of interbedded layers of clay, silty sand and gravel, and mixtures of the same.

Split-spoon soil samples were taken at depths of 10 feet and 15 feet. At a depth of 15 feet, sandy clay material upwelled inside the auger when the plug was removed to allow for split-spoon soil sampling. The auger was flushed with clean water to remove the upwelled material. Approximately 100 gallons of water obtained from U.S.A.R.C. Building 312 were used to remove the material.

Two-inch (I.D.) stainless steel screen, with 0.010-inch openings was placed over the 8-foot to 18-foot depth interval. Two-inch (I.D.) stainless steel casing was placed from 3.1 feet above the ground surface to a depth of 8 feet.

Red flint filter pack sand (No. 30) was placed in annular space between the well screen, casing, and native formation over the 7-to 18.5-foot depth. The geologic strata present in the screened interval consisted of clayey silt, silty clay, silty gravelly sand, and silty sand.

A 2-foot thick bentonite seal was placed above the filter pack. A 4-inch diameter, steel protective casing was placed over the observation well casing. A 5-foot thick concrete collar was placed above the bentonite seal and extended upward to the ground surface. The concrete was sloped away from the protective casing to facilitate surface water drainage away from the well.

Piezometer (P-113A)

Boring B-113A was drilled and sampled on November 15 and 16, 1988. Construction of piezometer P-113A was completed on November 16.

This boring was drilled to a depth of 44.5 feet, at which depth bedrock was apparently encountered. No samples of bedrock were obtained, however. The geologic strata penetrated by this boring consisted of interbedded layers of clay, silt, sand, and mixtures of the same.

Two-inch (I.D.) stainless steel screen with 0.010-inch openings was placed from a depth of 38.8 feet to 44 feet. Two-inch (I.D.) stainless steel casing was placed from 3 feet above the ground surface to a depth of 38.8 feet.

Red flint filter pack sand (No. 30) was placed in the annular space between the well screen, casing, and native formation from a depth of 33.5 feet to 44.5 feet. The native formation in the screened interval consists of clay and well-sorted sand.

A 7-foot thick bentonite seal was placed above the filter pack. Approximately 19.5 feet of bentonite-sand-grout backfill was placed above the bentonite seal. A 2-foot thick, bentonite pellet seal was placed above the bentonite-sand slurry. A 4-inch diameter, steel protective casing was placed over the piezometer casing pipe and a 5-foot thick concrete collar was placed to the surface. The concrete was sloped away from the protective casing to facilitate surface water drainage away from the well.

4.2.3 Borehole Monitoring

Atmospheric monitoring was conducted during the soil boring and soil sampling operations with an HNu photoionization detector. This instrument is useful in the detection of selected volatile organics.

Borehole monitoring was accomplished by inserting the tip of the HNu into the borehole annulus. Formation samples were placed in zip-lock bags and the HNu probe was inserted through a small opening in the zip-lock to monitor air quality. No detects were observed in either the formation samples or the borehole.

The borehole was also periodically monitored for oxygen concentration and lower explosive limit with a combustible gas/oxygen indicator. No air quality anomaly was observed with this instrument.

An oily film was briefly observed on water seeping from drill cuttings collected during the drilling of boring B-113A. However, no volatile organics were detected with the HNu.

4.2.4 Well Development

Twin City Testing Corporation initiated well development after a minimum of 48 hours had elapsed following well construction. Well development is performed to remove fine-grained material from the well annulus, enabling a representative sampling of the groundwater. Each well was developed by pumping and/or surging the well with a hand pump, without the use of acids, dispersing agents or explosives.

Before, during, and after completion of purging, the chemical and physical characteristics of the water removed from each well were measured and documented. Measurements obtained included turbidity, color, odor, conductivity, pH and temperature. Wells OW-112B and P-112A were developed until a volume equaling five times the standing water volume in each well had been removed, or until the water was clear and the physical parameters were constant (± 10 percent). Approximately four well volumes were removed from Well OW-113B. Piezometer P-113A was purged dry, and then one well casing volume of distilled water was added to the well.

After the water was added, the well was surged and purged dry again. All well development information was recorded on a well purging and sample collection log (Appendix E).

Water levels were measured and recorded prior to purging each well. Well OW-112B was developed until 160 gallons were removed and the pH and conductivity had stabilized at 7.20 +0.1 and 1000+ umhos/cm, respectively. Similarly, piezometer P-112A was developed until the water was clear, and the conductance had stabilized at 800 umhos/cm. A stabilized pH value of 6.80 +0.1 was recorded for piezometer P-113A after 75 gallons had been removed. Some fluctuations were noted in the pH and conductance for Well OW-113B even after 100 gallons had been removed from the well.

4.3 Site Stratigraphy

The stratigraphic information obtained from borings B-112A/B-112B differs markedly from that observed in borings B-113A/B-113B. Soils encountered in borings B-112A/B-112B were much coarser in the basal portion compared to those penetrated in borings B-113A/B-113B, which were predominantly fine-grained.

The surface soils in the vicinity of well nests OW-112B/P-112A and OW-113B/P-113A appear to be silt-clay loams developed within a silty-clay drift. The soils appear to be poorly aerated and drained as evidenced by the abundant clay content and faint mottling. The permeability of the surface soil appears to be low (estimated at .1 to .5 inches per hour).

Well Nest OW-112B/P-112A

The soils at borings B-112A/B-112B generally consist of gray to brown-gray, gravelly sand and sandy gravel below a depth of 21 feet (to bedrock). Gravelly sands encountered contain a high percentage of angular limestone (dolomite) rock fragments, and a trace of subround gravel of igneous origin.

Gray-brown, silty clay with micrite clasts occurs over the 20-21 foot depth increment. Tan-gray, gravelly sand is present over the 15 to 20-foot depth. This sand unit is overlain by gray, gray-brown, buff and brown clayey silt and silty clay. The clayey silt at a depth of approximately 5 feet was faintly laminated. The laminites consisted of alternating silt and clay. Faint green mottling was apparent at a depth of 6 feet.

Well Nest OW-113B/P-113A

Bedrock was presumably encountered at a depth of 44.5 feet in borings B-113A/B-113B as the split-spoon sampler could not be advanced any further (no bedrock sample obtained). The strata encountered at this location consist primarily of silty-clay and clay, with occasional intercalated sand layers.

The color of the formation is predominantly gray in the basal 35 feet of the section, changing to light-gray to brown in the upper 10 feet. A trace of angular to round gravel (limestone/dolomite) was observed. Faint laminations were noted in a silty clay occurring at a depth of 26 to 27 feet.

4.4 Bedrock Configuration

Past and present boring programs conducted at the U.S.A.R.C. site has provided useful information regarding the configuration of the bedrock in the study area. In general, the attitude of the bedrock surface appears to mimic surface topography.

Based on available data, bedrock relief across the study area is approximately 30 feet. Lowest bedrock elevations occur in the vicinity of borings B-105A/B-105B and B-106A/B-106B. The maximum bedrock elevation (660 feet above mean sea level) occurs as a localized knob (bedrock "high") near borings B-108A/B-108B and B-109A/B-109B. It is also possible that the bedrock "high" is part of a northeast-southwest trending ridge. General slope of the bedrock surface across the study area is toward the south-southwest.

RP/USARMMY/M/AB1

5.0 HYDROGEOLOGY

Several lakes are present in the vicinity of the U.S.A.R.C. complex. Many are groundwater-dominated seepage lakes, hydraulically connected to the local groundwater system. Figure 4 shows water table contours derived from surface elevations recorded at nine lakes located in the vicinity of the U.S.A.R.C. The base map is a U.S.G.S. quadrangle, photo-revised in 1976. Water elevations recorded for each lake, suggest that regional groundwater flow is directed towards the southeast, with an average horizontal hydraulic gradient of approximately .006 ft/ft. The hydraulic gradient observed between higher and lower elevation lakes is not necessarily constant and may be influenced by local recharge mounds.

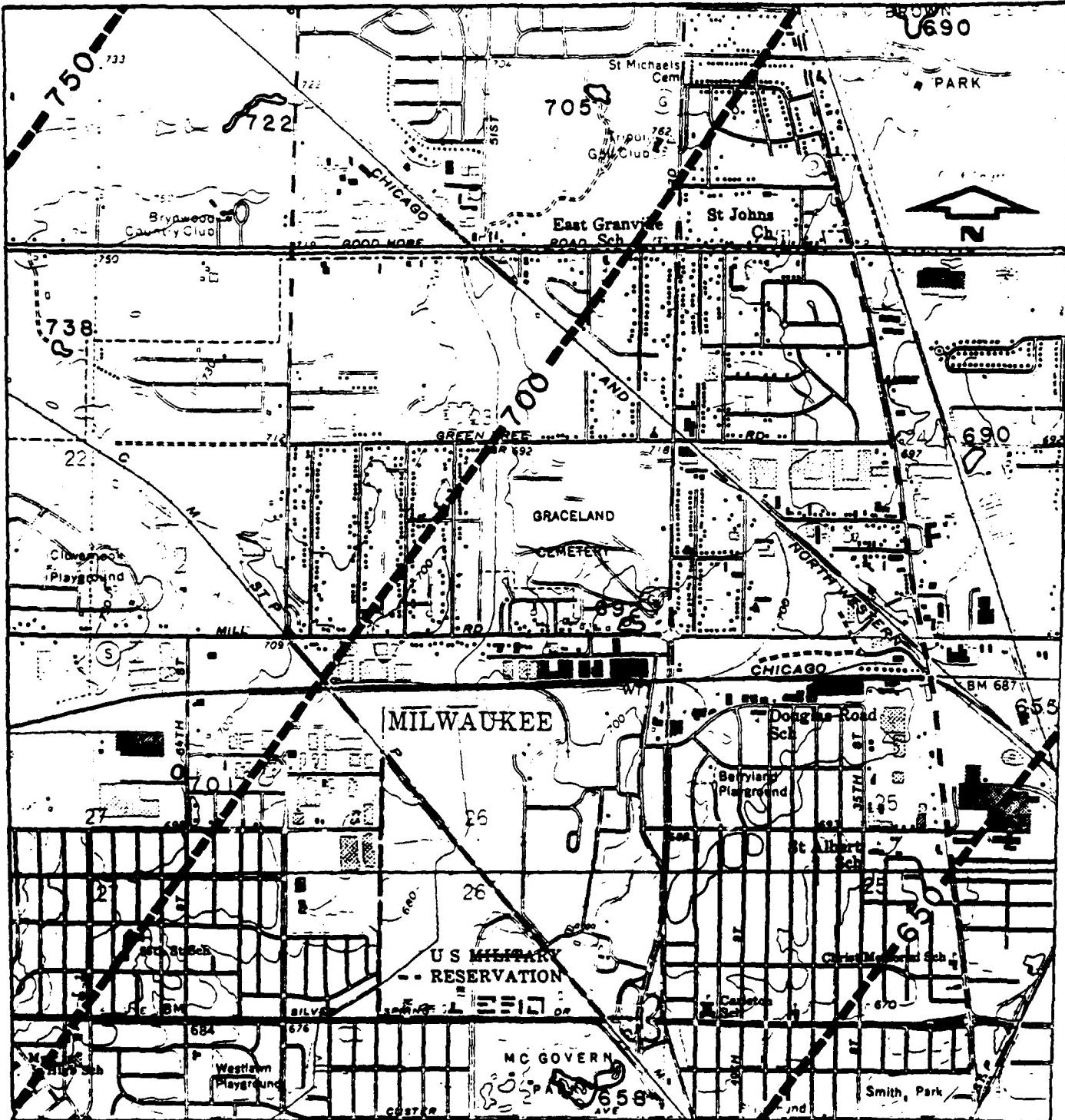
5.1 Site Hydrogeology

The hydrogeologic characteristics of the glacial drift unit have been studied more extensively than the hydrogeology of the underlying Niagara Dolomite at the U.S.A.R.C. site. Twenty wells installed at this site are screened in drift unit. The remaining two wells (P-108A, P-109) are screened 10 and 9 feet into the underlying limestone (dolomite).

Groundwater elevation data was obtained from all observation wells and piezometers during the course of this project (March, 1989). This information and historic water level data is summarized in Table 2.

Water level measurements taken on March 1, 1989 have been used to show the present configuration of the water table at the U.S. Army Reserve site (Figure 5). The water table map which has been prepared illustrates the general magnitude of observed horizontal gradients and direction of groundwater flow. The horizontal hydraulic gradient in the vicinity of wells P-101A/OW-101B and P-102A/OW-102B, southward to wells P-105A/OW-105B is approximately .002 ft/ft. The horizontal hydraulic gradient between well nests P-108A/OW-108B and P-106A/OW-106B is approximately .02 ft/ft.

Groundwater flow is directed towards areas of decreasing hydraulic head, as indicated by the arrows on Figure 5. Th contoured water table elevation data suggests that groundwater is directed radially away from the bedrock "high" located near well nest OW-108B/P-108A. The predominant direction of groundwater flow away from this location, across other areas of the site, varies from southwesterly in the northern part of the study area, to southeasterly in the vicinity of well nests P-105A/OW-105B and P-106A/OW-106B.



SCALE

1" Equals 2000'

LEGEND

690 Lake Surface Elevation

— 700 — Water Table Contour
Elev. (Ft.)
Datum (M.S.L.)

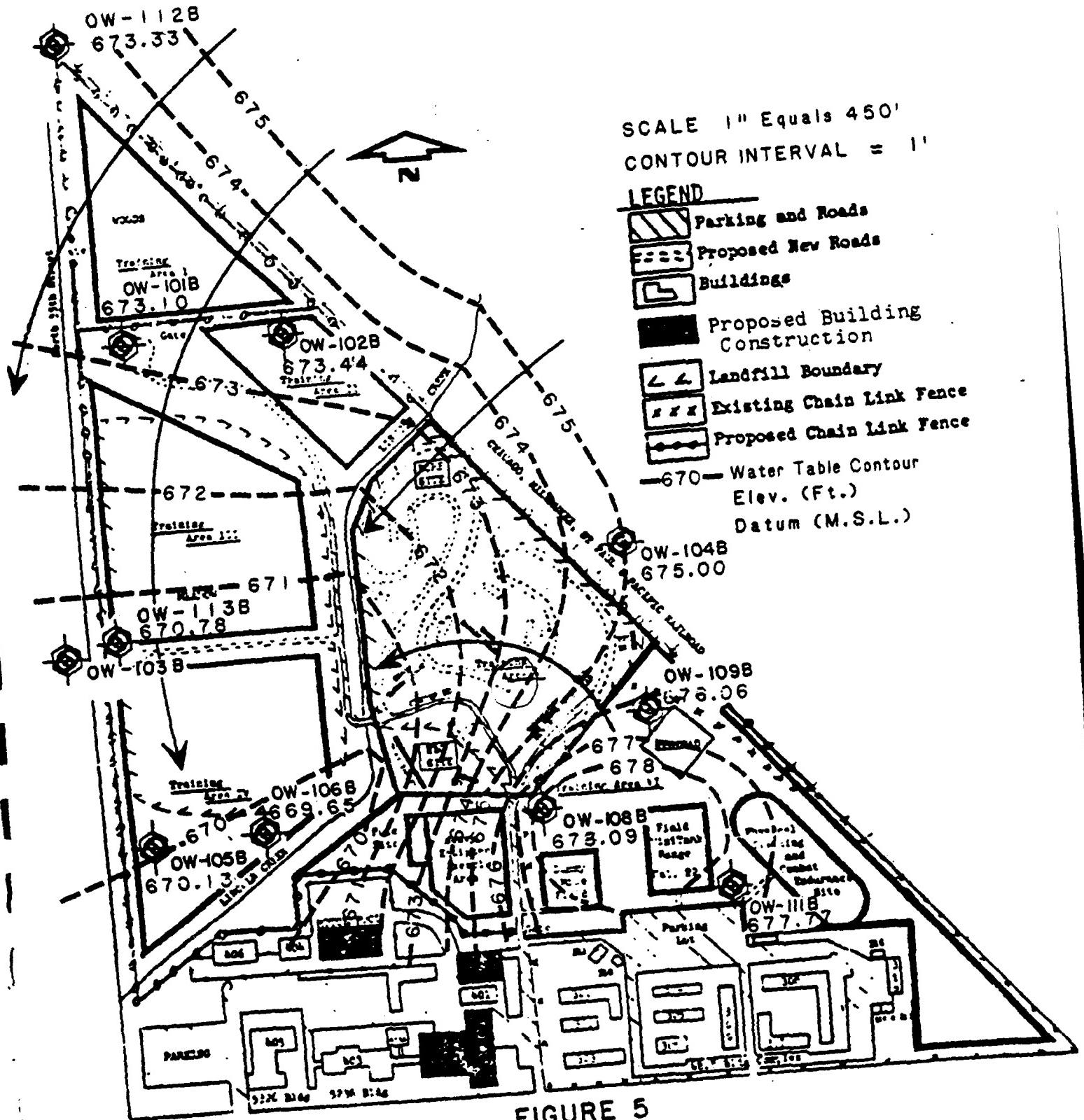
FIGURE 4
WATER TABLE MAP
BASED ON LAKE ELEVATIONS
MILWAUKEE U.S.A.R. CENTER
COMPLEX AND TRAINING AREA
MILWAUKEE, WISCONSIN
DONOHUE & ASSOCIATES
1989

TABLE 2
GROUNDWATER ELEVATION DATA

US Army Reserve 84th Division

Monitoring Well Elevation

Well No.	T.O.P.(MSL)	1/87	3/87	5/87	7/87	9/87	12/88	1/89	2/89	3/1
P-101A	686.76	676.05	676.28	677.16	675.69	676.67	673.39	674.35	674.36	674.34
DW-101B	686.89	675.58	675.89	676.64	675.35	676.21	673.14	673.14	673.15	673.10
P-102A	685.99	675.95	676.20	676.95	675.59	676.56	673.14	673.37	673.37	673.21
DW-102B	686.04	676.04	676.35	677.09	675.71	676.64	673.47	673.47	673.48	673.44
P-104A	692.11									Frozen
DW-104B	691.98	680.67	677.32	678.22	676.13	677.24				675.00
P-105A	677.43	671.74	672.25	672.76	671.75	672.44	669.33	669.38	669.36	669.34
DW-105B	677.28	670.84	670.84	671.58	670.80	671.39	669.99	670.12	670.15	670.13
P-106A	677.02	670.06	670.65	670.73	669.97	670.78	669.56	669.01	669.02	668.98
DW-106B	677.07	669.88	670.95	670.74	669.33	670.54	669.38	669.67	669.68	669.65
P-108A	696.48	680.31	681.65	682.45	679.88	682.18				676.11
DW-108B	696.58	686.25	687.61	688.09	685.52	687.63				678.09
P-109A	694.88	679.59	681.08	681.80	679.13	681.36				675.12
DW-109B	694.99	679.99	681.62	682.48	679.57	681.92				676.66
P-111A	690.97	677.80	679.31	680.58	677.76	679.87				673.20
DW-111B	690.93	681.26	683.31	684.15	681.26	683.66				677.77
P-112A	691.22						673.28	673.32	673.33	673.30
DW-112B	691.36						673.35	673.33	673.34	673.33
P-113A	682.98						670.76	670.74	670.75	670.73
DW-113B	682.94						670.73	670.76	670.80	670.78



Vertical gradients vary from strongly downward in well nests P-108A/OW-108B, P-109A/OW-109B, P-104A/OW-104B, and P-111A/OW-111B, to strongly upward at well nest P-101A/OW-101B. Strong downward gradients are indicated for wells located in the vicinity of the bedrock "high". Groundwater appears to move downward and radially away from this area.

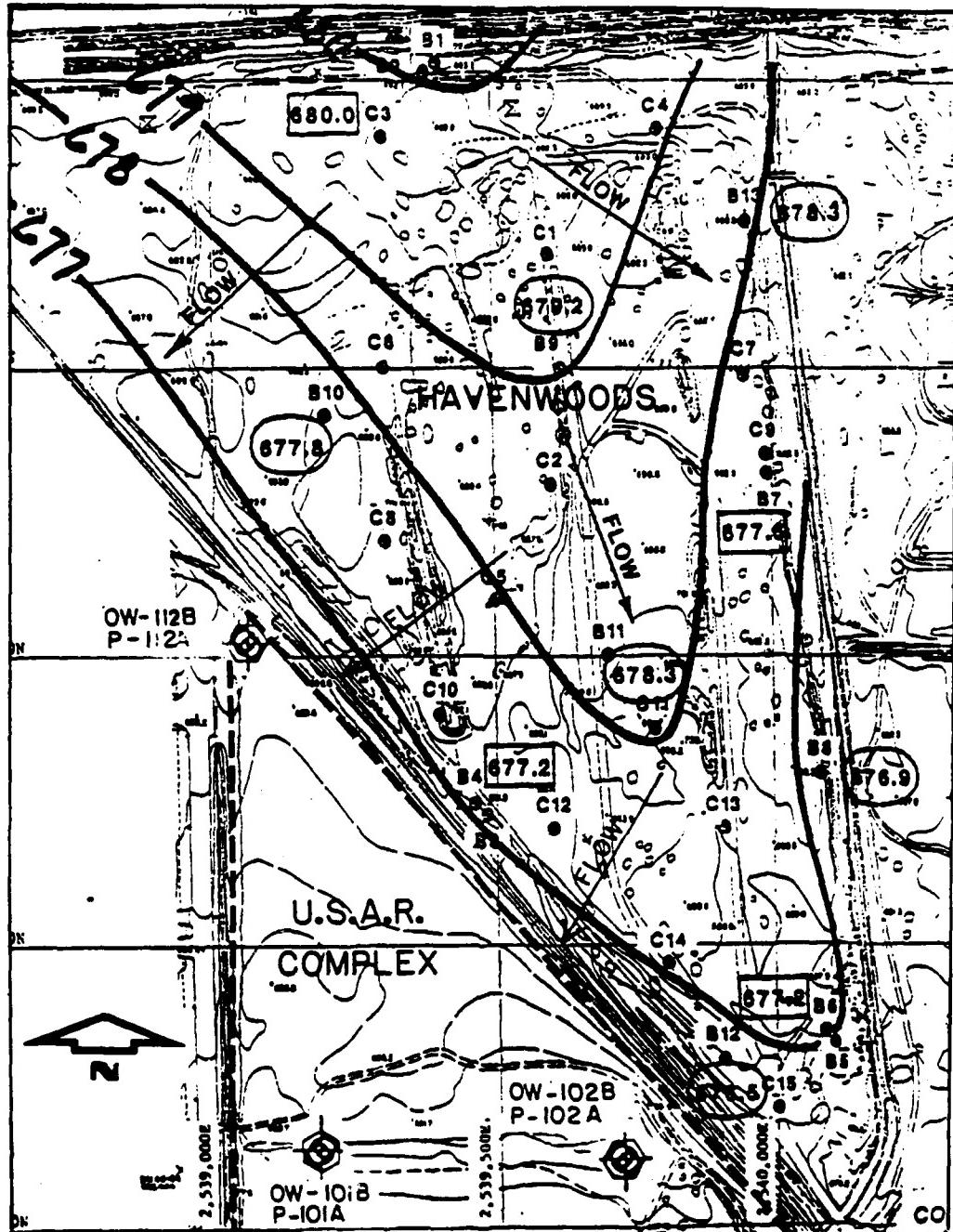
The observed groundwater mound located near well nest OW-108B/P-108A is recharged by local precipitation. Recharge to the aquifer in other areas of the site is obtained from local precipitation and infiltration flow.

In 1986-1987 Miller Engineers conducted a groundwater investigation at the Havenwoods Nature Preserve located northeast of the U.S.A.R. Center complex and training area. Staff with Miller Engineers concluded that "horizontal flow directions are to the southeast south-southwest toward both Lincoln Creek and the U.S. Army Reserve Complex". Figure 6 shows the configuration of water table at the Havenwoods study area developed from water level measurements taken in 1986 and 1987.

The water table map presented by Miller Engineers for the Havenwoods study area generally coincides with the water table map developed from this study. Groundwater is migrating from the vicinity of the Havenwoods study area toward the U.S.A.R. Center complex and training center.

The relationship between Lincoln Creek and the aquifer system is not known with certainty. It appears that water levels measured in observation wells OW-102B and OW-106B are at approximately the same elevation as water levels in Lincoln Creek. It is believed that Lincoln Creek is hydraulically connected to the drift aquifer and that flow in the creek is primarily sustained by groundwater discharge.

RP/USARMY/M/AB2



SCALE

1" Equals 350'

LEGEND

- 678 — Water Table Contour
- Elev. (Ft.)
- Datum (M.S.L.)

FIGURE 6
WATER TABLE MAP
HAVENWOODS STUDY AREA
MILWAUKEE U.S.A.R. CENTER
COMPLEX AND TRAINING AREA
MILWAUKEE, WISCONSIN
DONOHUE & ASSOCIATES
1989

6.0 GROUNDWATER SAMPLING AND ANALYSIS

6.1 Groundwater Sampling

Groundwater samples were obtained from selected wells on December 21 and 22, 1988, and January 23 and 24, 1989, following proper well construction and development. Wells sampled for volatile organics included:

P-101A/OW-101B	P-106A/OW-106B
P-102A/OW-102B	P-112A/OW-112B (new wells)
P-105A/OW-105B	P-113A/OW-113B (new wells)

Table 3 provides a listing of the organic analytes determined by Donohue Analytical, and their associated analytical detection limits.

In addition, groundwater samples collected from each newly-installed well were analyzed for selected Public Health and Welfare Standards, and Indicator Parameters as shown in Table 4. These include:

1. Field parameters including temperature, pH, color, odor, turbidity and specific conductance.
2. Dissolved metals including iron, barium, chromium, mercury, lead, cadmium and arsenic.
3. Indicator parameters including COD, BOD, hardness, odor, alkalinity, nitrate + nitrite, ammonia-nitrogen, chloride, sulfate and boron.

Purging was conducted prior to sampling activities to ensure the collection of a representative groundwater sample. Samples were obtained by using a teflon bailer attached to a nylon rope. The first several bailer volumes retrieved from each well were discarded prior to sample collection. Sampling equipment was decontaminated between successive locations with liquinox and distilled water.

The physical characteristics of the groundwater obtained before, during and after the purging were recorded. Parameters noted included turbidity, color, odor, conductivity, pH and temperature. Each well was purged until stabilization of these parameters had occurred ($\pm 10\%$).

Analytical methods and groundwater sampling requirements are presented in Table 5. This table also indicates bottle and preservative requirements employed during groundwater sampling. Groundwater samples to undergo analysis for dissolved metals were field filtered using a 0.45 micron filter and a positive pressure filtering apparatus. Samples collected for volatile organics were not field filtered.

TABLE 3
ORGANIC ANALYTES
84th U.S. Army Reserve Complex and Training Center

<u>CAS Number</u>	<u>Donohue Analytical Detection Limit (ug/l)</u>	<u>Volatiles</u>
74-87-3	<2	Chloromethane
74-83-9	<2	Bromomethane
75-01-4	<2	Vinyl Chloride
75-00-3	<2	Chloroethane
75-09-2	<1	Methylene Chloride
67-64-1	<5	Acetone
75-15-0	<10	Carbon Disulfide
75-35-4	<1	1,1-Dichloroethene
75-34-3	<1	1,1-Dichloroethane
156-60-5	<1	Trans-1,2-dichloroethene
67-66-3	<1	Chloroform
107-06-2	<1	1,2-Dichloroethane
78-93-3	<10	2-Butanone
71-55-6	<1	1,1,1-Trichloroethane
56-23-5	<1	Carbon Tetrachloride
106-05-4		Vinyl Acetate
75-27-4	<1	Bromodichloromethane
78-87-5	<1	1,2-Dichloropropane
10061-02-6	<1	Trans-1,3-Dichloropropene
79-01-6	<1	Trichloroethene
124-48-1	<1	Dibromochloromethane
79-00-5	<1	1,1,2-Trichloroethane
71-43-2	<1	Benzene
10061-01-5	<1	Cis-1,3-Dichloropropene
110-75-8	<1	2-Chloroethylvinylether
75-25-2	<1	Bromoform
591-78-6	<10	4-Methyl-2-Pentanone
108-10-1	<25	2-Hexanone
127-18-4	<1	Tetrachloroethene
79-34-5	<1	1,1,2,2-Tetrachloroethane
108-88-3	<1	Toluene
108-90-7	<1	Chlorobenzene
100-41-4	<1	Ethylbenzene
100-42-5	<1	Styrene
	<2	Total Xylenes

RP/USARMY/M/AA3

TABLE 4

FIELD PARAMETERS AND INORGANIC ANALYTES
84th U.S. Army Reserve Complex and Training Center

Indicator Parameters:

BOD
Alkalinity
COD
Hardness
Ammonia/Nitrogen

Field Parameters:

Temperature
Conductivity
pH
Turbidity
Color
Odor

Public Welfare Standards:

Chloride
Dissolved Iron
Sulfates

Public Health Standards:

Nitrate and Nitrite - Nitrogen

Other Dissolved Metals to Include:

Arsenic
Barium
Boron
Cadmium
Chromium
Lead
Mercury

RP/USARMM/AA3

TABLE 5
ANALYTICAL METHODS AND GROUNDWATER SAMPLING REQUIREMENTS
84th U.S. Army Reserve Complex and Training Center

Analyte	Well Type	Detection Limit	EPA Method Number/Reference	Sample Container	Preservative(s)	Holding Time
Color	P, E	-	Field Observation	Glass Jar	None	Analyze Immediately
Odor	P, E	-	Field Observation	Glass Jar	None	Analyze Immediately
Turbidity	P, E	-	Field Observation	Glass Jar	None	Analyze Immediately
pH	P, E	-	Field Observation	Glass Jar	None	Analyze Immediately
Conductivity	P, E	-	Field Observation	Glass Jar	None	Analyze Immediately
<u>DISSOLVED METALS</u>						
Arsenic	P	1 ug/l	206.3/1	250 ml HDPE Bottle	1:1 HNO ₃ to pH <2	6 Months
Barium	P	200 ug/l	208.1/1	250 ml HDPE Bottle	1:1 HNO ₃ to pH <2	6 Months
Boron	P	0.1 mg/l	212.3/1	250 ml HDPE Bottle	None	6 months
Cadmium	P	1 ug/l	213.2/1	250 ml HDPE Bottle	1:1 HNO ₃ to pH <2	6 Months
Chromium	P	2 ug/l	218.2/1	250 ml HDPE Bottle	1:1 HNO ₃ to pH <2	6 Months
Lead	P	2 ug/l	239.2/1	250 ml HDPE Bottle	1:1 HNO ₃ to pH <2	6 Months
Mercury	P	0.2 ug/l	245.2/1	250 ml HDPE Bottle	1:1 HNO ₃ to pH <2	28 days
Iron	P	50 ug/l	236.1/1	250 ml HDPE Bottle	1:1 HNO ₃ to pH <2	6 Months
<u>OTHER</u>						
Nitrate+Nitrite-Nitrogen	P	0.05 mg/l	353.2/1	250 ml Glass Bottle	1:1 H ₂ SO ₄ to pH <2, 4°C	28 Days
Ammonia-Nitrogen	P	0.10 mg/l	350.1/1	250 ml Glass Bottle	1:1 H ₂ SO ₄ to pH <2, 4°C	28 Days
Sulfate	P	2 mg/l	375.2/1	1000 ml HDPE Bottle	4°C	28 Days
Chloride	P	0.5 mg/l	325.2/1	1000 ml HDPE Bottle	None	28 Days

•• P Denotes newly-installed well; E denotes pre-existing well

TABLE 5
ANALYTICAL METHODS AND GROUNDWATER SAMPLING REQUIREMENTS
BATH U.S. Army Reserve Complex and Training Center
(Continued)

Analyte	Well Type	Detection Limit	EPA Method Number/Reference	Sample Container	Preservative(s)	Holding Time
Total Alkalinity	P	5 mg/l	310.2/1	1000 ml HDPE Bottle	4°C	14 Days
Hardness	P	5 mg/l	130.1/1	250 ml HDPE Bottle	1:1 HNO ₃ to pH <2	6 Months
COD	P	5 mg/l	410.4/1	250 ml Glass Bottle	1:1 H ₂ SO ₄ to pH <2, 4°C	28 Days
BOD	P	2 mg/l	405.1/1	1 liter HDPE Bottle	None	48 Hours
ORGANICS						
Volatile Organics	P, E	1-5 ug/l*	624	Vials, Teflon Septa, No Headspace	(2) 40 ml glass	4°C
						14 Days

References:

1. EPA-600/4-79-020 revised 1983. "Methods for Chemical Analysis of Water and Wastes"
2. 40 CFR Part 136, Federal Register, October 26, 1984.

*Varies by compound, refer to method.
** P Denotes proposed well; E denotes existing well

Table 6 summarizes Donohue quality assurance/quality control requirements. Quality assurance standards for volatile organics were satisfied by collecting one duplicate, trip blank and field blank during each sampling event. Field blanks consisted of rinsates.

Specific sampling techniques and protocols utilized during this investigation are discussed further in the project workplan prepared by Donohue, entitled "Monitoring Well Installation and Groundwater Sampling and Analysis Plan" (November, 1988). This workplan also describes sample documentation, and sample handling procedures.

6.2 Groundwater Analysis and Results

Groundwater sampling results obtained during December, 1988, and January, 1989, are presented in Appendix F of this report. This appendix also includes historic groundwater quality data from 1987. A summary memorandum prepared by the Donohue Laboratory Quality Control Coordinator discussing data quality is also included in this appendix. Sampling events are summarized by well for indicator parameters, and volatile organic compounds.

6.2.1 Indicator Parameters

Concentrations of COD ranging from 15 to 30 milligrams per liter (mg/l) were observed in wells OW-101B/P-101A, OW-102B/P-102A, and P-105A. The remaining wells monitored at the site contained COD concentrations below the analytical detection limit of 5 mg/l. Analytical data obtained during this investigation, and historic water quality information indicates that BOD concentrations are near or below the analytical detection limit.

Boron concentrations in groundwater samples obtained from the site are less than 1 mg/l.

Generally, above normal conductivity values were observed at all well locations. Conductivity values observed in the groundwater samples obtained from this site ranged from 800 to 1400 micromhos. High specific conductivities was also observed in well OW-112B.

Near neutral pH values were observed at all locations across the site except near well locations 112 and 113 where pH values ranged from 7.6 to 9.2 units. Total hardness concentrations at all wells were generally in the 500 to 900 mg/l range. Alkalinity values ranged from 300 to 500 mg/l.

TABLE 6

QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS
84th U.S. Army Reserve Complex and Training Center

<u>Well Type</u>	<u># Field Samples</u>	<u># Field Blanks</u>	<u># Trip Blanks</u>	<u>#Field Duplicates</u>
Existing	8	1	0	0 *
New	4	1	1	1 *

* One field duplicate taken during each event. Second event field duplicate will be from well exhibiting detectable volatile organics in first event.

Sample Containers for Each
Field Sample, Blank, Duplicate

<u>Analyte(S)</u>	<u>Container</u>
1. Metals, Hardness	1-liter HDPE bottle with 1:1 HNO ₃ to pH <2
2. Sulfate, chloride, BOD, alkalinity	1-liter HDPE bottle cool to 4°C
3. Ammonia, COD Nitrate + nitrite	1-250 ml glass bottle, 1:1 H ₂ SO ₄ to pH <2
4. Volatile Organics	(2) 40 ml glass vials with Teflon septa, no headspace, 4°C

RP/USARMY/M/AA3

6.2.2 Public Welfare Parameters

Elevated chloride concentrations were observed at all monitoring well locations at the USARC site. The only noted exception occurred at well OW-106B, which contained approximately 20 mg/l chloride. Intermediate chloride concentrations, reaching a maximum of 100 mg/l, were observed at well locations 101, 102, 105, and 113. This concentration range is below the established Wisconsin DNR Preventative Action Limit (PAL). Highest chloride concentrations approached 200 mg/l for wells P-112A/OW-112B (upgradient). While the chloride concentration observed at well location 112 exceeds the PAL, the Enforcement Standard (ES) was not attained.

Observed sulfate concentrations generally fall in the range from 200 to 300 mg/l. The PAL established for sulfate was exceeded in all wells, and several wells exceeded the ES.

Dissolved iron concentrations are extremely variable across the USARC site. Analytical results range from the analytical detection limit of 0.05 mg/l to values exceeding 3 mg/l. In general, the concentration Enforcement Standard. Consistently high iron concentrations have been observed in wells P-101A, P-105A, P-112A, and OW-112B.

6.2.3 Public Health Parameters

The concentration of toxic metals in the groundwater at this site was generally below the analytical detection limit. Nitrate + nitrate-nitrogen concentrations were also near or below the analytical detection limit (all locations).

Volatile organic compounds (VOCs) have been detected at all well locations monitored during this program. Vinyl chloride presence was not confirmed in wells OW-101B, P-101A, OW-102B, P-102A, and P-105A. Elevated vinyl chloride concentrations were observed in these wells during the February 1987, and July 1987, sampling events. The compound cis-1, 2-dichloroethylene was confirmed in wells OW-101B, OW-102B, and P-102A. Concentrations observed are similar to those detected during 1987 sampling events.

Dichlorobenzene isomers were detected in wells P-102A, P-105A, OW-105B, OW-106B, P-106A, and P-113A. Only well P-102A showed comparable isomer concentrations during the most recent (December, 1988; and January, 1989) sampling events.

The highest concentrations of volatile organic compounds were detected in groundwater samples obtained from well nest OW-112B/P-112A (upgradient). Maximum concentrations deleted were: cis-1, 2-dichloroethylene, 762 mg/l; trichloroethylene, 209 mg/l; 1-dichloroethane, 104 mg/l. Elevated concentrations were confirmed during both the December, 1988, and January, 1989 events. The majority of volatile organics detected at well nest OW-112B/P-112A are ES exceedances.

7.0 SUMMARY AND CONCLUSIONS

Previous studies by Donohue (1985) and Foth and Van Dyke (1988) have shown that groundwater at the U.S.A.R.C. complex has been impacted by chloride, arsenic, cadmium, iron, and volatile organic compounds. Analytical data obtained during this investigation has also documented groundwater impact at several monitoring well locations across the site. Enforcement standards have been exceeded for sulfate, dissolved iron, and volatile organic compounds. The most significant impacts in groundwater quality were observed near the northern portion of the U.S.A.R.C. site. Well nest OW-112B/P-112A have shown PAL and ES exceedances for selected indicator, public welfare, and public health parameters, including volatile organic compounds.

Groundwater elevation data obtained during this study has indicated that generally groundwater flow within the shallow unconfined water table system is directed towards the south and southwest. A subsurface study conducted at the Havenwoods Nature Preserve located just northeast of the U.S.A.R.C. complex also indicated that groundwater flow is directed southeast-southwest from the Havenwoods Nature Preserve, towards Lincoln Creek and the U.S.A.R.C. site. This information indicates that the most impacted well nest (P-112A/OW112B) is located upgradient from the U.S.A.R.C. site, and downgradient from the Havenwoods Nature Preserve. Based on the information obtained during this investigation and summarized in this report it appears that the groundwater impacts presently observed at the U.S.A.R.C. site have resulted from an off-site source located northeast of the U.S.A.R.C. site.

RP/USARMY/M/AB4

BIBLIOGRAPHY

- Donohue & Associates, 1985, Landfill Impact Evaluation, USAR Center Complex and Training Area, Milwaukee, Wisconsin; prepared for U.S. Army Corps of Engineers (Omaha).
- Donohue & Associates, 1988, Monitoring Well Installation and Groundwater Sampling and Analysis Plan for the U.S. Army Training Reserve - 84th Division, Milwaukee, Wisconsin (project work plan).
- Foth & VanDyke, 1988, Landfill Sampling and Analysis, USARC, West Silver Spring Drive, Milwaukee, Wisconsin; prepared for U.S. Army Corps of Engineers (Fort McCoy).
- Giles Engineering, 1985, Boring Logs, Soil Classification, and Well Diagrams, U.S. Army Reserve Training Center, Milwaukee, Wisconsin.
- Miller Engineers, 1988, Hydrogeologic Investigation and Groundwater Quality Assessment Report, Haven Woods State Forest, Milwaukee, Wisconsin; prepared for Wisconsin Department of Administration.
- Twin City Testing, 1988, Report of Subsurface Exploration and Monitoring Well Installation Program, United States Army Reserve Center, Milwaukee, Wisconsin.

RP/USARMY/M/AB5

ATTACHMENT 1

**DEPARTMENT OF ARMY
REQUEST FOR PROPOSAL
SCOPE OF SERVICES**



DEPARTMENT OF THE ARMY

HEADQUARTERS, FORT MCCOY
SPARTA, WISCONSIN 54656-8000

August 10, 1988

REPLY TO
ATTENTION OF

Acting Chief, Engineering Plans
and Services

Donohue & Associates, Inc.
1705 Wilson Avenue
Plover, Wisconsin 54467

Gentlemen:

You are requested to submit your proposal for Open-End Contract No. DACA45-87-D-0075 for Monitoring Well Construction and Groundwater Analysis Milwaukee, WI., project number HA01005-8P.

Description of work is outlined in the enclosed scope of work.

Required completion date is presently set at March 1, 1989.

Fee negotiation for this work order proposal is to be conducted with your firm's representative at Building 2111, Directorate of Engineering, Engineering Plans and Services Division, Fort McCoy, Wisconsin, on August 31, 1988, at 1:00 PM.

Fee shall include all costs for accomplishing the work stated in the scope of work to include any fees for state plan reviews and approvals.

Sincerely,

A handwritten signature in black ink, appearing to read "John O. Calvert".

John O. Calvert
Acting Chief, Engineering Plans and
Services Division
Contracting Officer's Representative

Enclosures

SCOPE OF WORK

1. TITLE AND IDENTIFICATION OF PROJECTS:

- a. Projects shall be identified by the following Fort McCoy names and related numbers:

1) Project Name: Monitoring Well Construction and Groundwater Analysis; 84th Division, Milwaukee, WI

Project Number: HA01005-8P

Drawing Number: 47-018-2041

- b. Purpose:

- Install two well nests.
- Determine source direction for elevated levels of vinyl chloride.
- Monitor and evaluate other groundwater quality parameters.

2. PROJECT COORDINATION:

- a. The project shall be coordinated through Mr. John Esson at Fort McCoy, phone (608) 388-2408.

3. PROJECT REVIEW:

- a. The project shall be reviewed by Fort McCoy at 50% and 98% completion. The 50% completion represents completion of all well construction and first round water sampling and analysis.

- b. The reviews shall be conducted in Building 2171 at Fort McCoy. Attendees will include your firm's representative(s), contracting officer representative, project manager and other representatives within the Directorate of Engineering (DE) and 84th Division.

- c. Provide six (6) copies of well construction and lab analysis reports for the first round groundwater analysis.

- d. Provide eight (8) copies of the final evaluation report one week prior to the 98% meeting.

- e. A complete report of project findings and evaluation of the source, extent and degree of any contamination shall be submitted. The report shall include complete well construction documentation and diagrams.

The draft report shall be submitted to Fort McCoy 90 calendar days after the notice to proceed. The final report shall be submitted 150 days after the notice to proceed.

- f. A qualified hydrogeologist shall interpret all geologic and hydrogeologic data and sign the final report. The report must also include the following statement:

"I, (hydrogeologist's signature) certify that I am a hydrogeologist and meet or exceed the requirements of

NR.500.03(64), Wisc. Admin. Code."

- g. All documents shall be submitted in accordance with NR 500.05.
- h. Fort McCoy reserves the right to schedule additional intermediate reviews if necessary. Your firm shall provide copies of review comments as indicated above. All reviews shall be scheduled a minimum of one week in advance.

4. BACKGROUND INFORMATION:

Two (2) groundwater investigations have been completed to date. Elevated levels of vinyl chloride were detected in some north and west monitoring wells, but additional monitoring wells are required to determine if the contamination source is on US Army Reserve property. The following reports and data will be available for review and guidance:

- a. Donohue & Associates, Inc. 1985. Landfill Impact Evaluation, USAR Center Complex & Training Area, Milwaukee, Wisconsin. Included well construction documentation and groundwater analysis.
- b. Foth & Van Dyke & Associates, Inc. 1988. Landfill Sampling and Analysis, USARC, West Silver Spring Drive, Milwaukee, Wisconsin. Includes VOC and inorganics groundwater analysis and landfill cap analysis.

5. GENERAL TASKS:

Work shall include constructing two (2) well nests, collecting water samples and analyzing for inorganics and volatile organic compounds (VOC). Contractor shall coordinate with the Wisconsin Department of Natural Resources (WDNR) for required detection limits. Contractor shall also interpret test results and prepare a detailed technical report of the project findings.

6. SPECIFIC REQUIREMENTS:

a. Well Construction/Development

- 1) Install two (2) groundwater monitoring well nests, consisting of two wells each, as shown on the Milwaukee Site Plan (Encl 1). Wells will be constructed of 2-inch casings made of a material which will not react with or contaminate the groundwater. PVC is not acceptable. Boring samples shall be taken every 5 feet and as new geologic formations are encountered. Boring logs and well construction diagrams shall be prepared for each well. Well construction and development shall comply with WDNR requirements including NR 508.05, NR 508.06 and NR 1411 (proposed) or other DNR-approved methods.

- 2) Fort McCoy will provide the exact location of new monitoring wells at the time of construction.

b. Water sampling and laboratory analysis

- 1) Collect two (2) rounds of water samples from the following wells:

101A/101B	106A/106B
102A/102B	112A/112B (new wells)
105A/105B	113A/113B (new wells)

Sampling periods shall be as least 60 days apart.

- 2) Conduct gas chromatography (GC) scan for volatile organic chemical compounds on water samples taken above. All compounds detected in the GC scan shall also be quantified with a GC/MS scan.
- 3) Take water level measurements at each of the above wells on four (4) occasions.
 - During each sampling round.
 - 30 days following the 1st sampling round.
 - 30 days following the 2nd sampling round.
- 4) For new monitoring wells #112A/112B and 113A/113B, conduct laboratory analysis on each sample collected for:

Field H₂O temp.
Field pH
Field conductivity (corrected to 25° C)
COD
BOD₅
Dissolved Iron
Hardness
Total Alkalinity
Nitrogen as NO₂ - NO₃
Ammonia as NH₃
Barium
Chloride
Sulfate
Chromium
Mercury
Lead
Cadmium
Arsenic
Boron
Color/odor/turbidity

- 5) Samples shall be tested in a laboratory certified for VOC's by the WDNR, in accordance with NR149.
 - 6) All parameters shall be tested at or below detection levels acceptable to the WDNR.
 - 7) Sampling and testing shall be performed by WDNR and EPA-approved methods and in accordance with the attached Sampling Standards guideline (Encl 2).
- c. Contractor shall evaluate the source of any contaminants and determine the source direction for the elevated levels of vinyl chloride.

7. BID PROPOSAL:

Bid proposal shall include the proposed well construction details including drilling techniques, construction materials, casing material, well depth, screen length, well seal type and depth, vandalism protective measures and quality control measures, etc.

8. OBLIGATIONS:

This project is subject to approval by the Wisconsin DNR. The project must be in compliance with, and must include all information required in, NR 508.05 and NR 149 or the Wisconsin Administrative Code, for submission to the DNR.

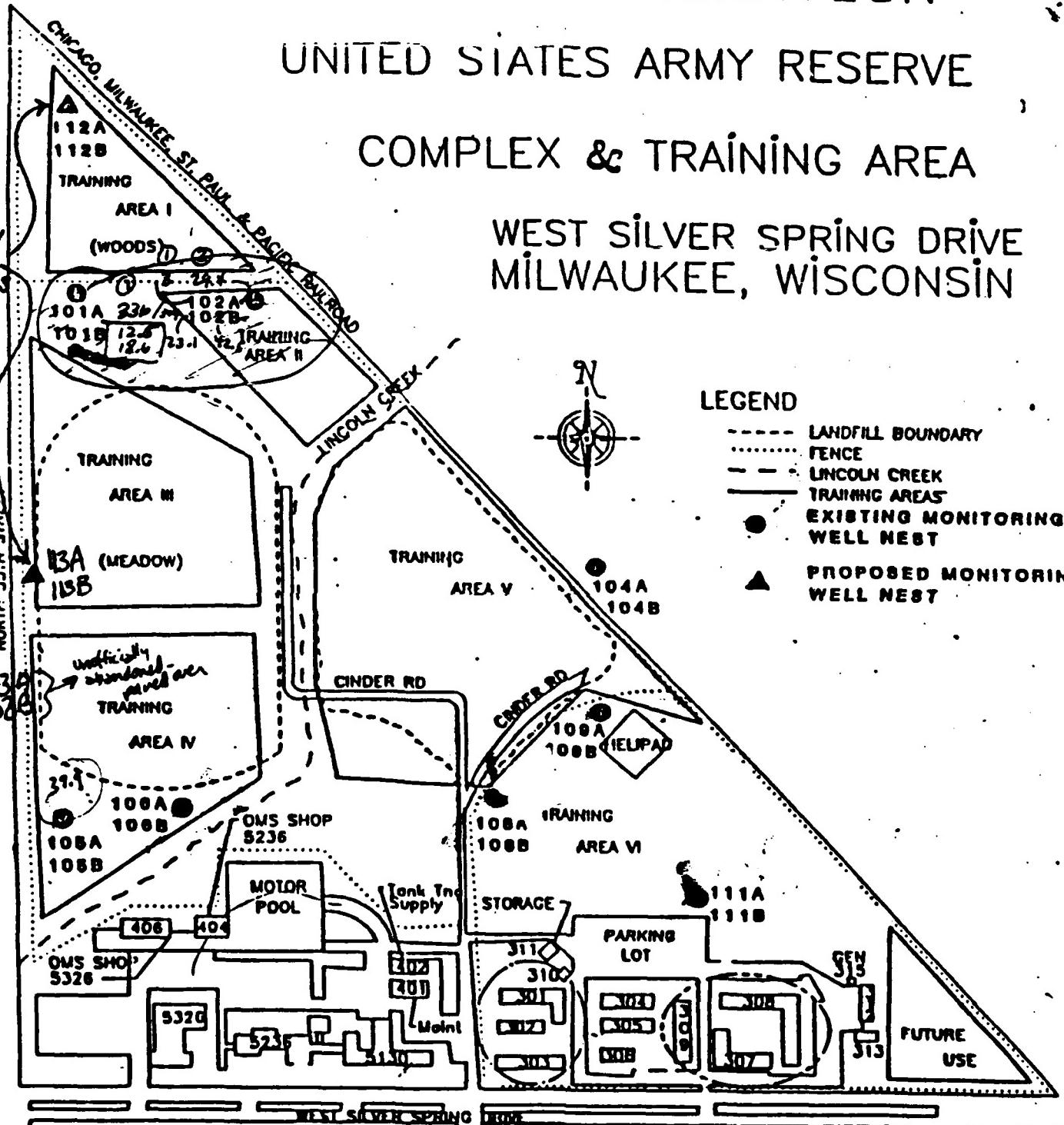
SUBJECT: Ground-Water Consultation No. 38-26-0876-88, th Division (Training),
Milwaukee, Wisconsin, 2-16 November 1987

CURRENT UTILIZATION

UNITED STATES ARMY RESERVE

COMPLEX & TRAINING AREA

WEST SILVER SPRING DRIVE
MILWAUKEE, WISCONSIN



SAMPLING STANDARDS

Water sampling on this project shall be conducted in accordance with the following paragraphs:

- I. All procedures for sampling and analysis shall be recorded each sampling period. Any deviations from standard procedures shall be noted and reason given for the change.

- A. Sampling Procedures. The methods used or proposed to be used to obtain, preserve and analyze groundwater samples shall be described. The following elements shall be included:
1. Filtering of the samples, especially for metals, shall be conducted in the field. Standard preservation techniques shall be followed
 2. Field blanks shall be obtained during the sampling program. One field blank at the start, at midpoint, and at the end.
 3. Device(s) used to retrieve samples.
 4. Procedures used to flush wells prior to collecting samples, with approximate water volumes removed and approximate time elapsed between flushing and sampling.
 5. Procedures for cleaning samplers (such as bailers) between wells.
 6. The order of well sampling from least to most contaminated, if known, or up-gradient to down gradient.
 7. Equipment used to measure conductivity and pH in the field.
 8. Volume of samples collected; procedures for filtering samples prior to analysis; procedures for chemical preservation of samples; and time at which filtration and preservation are carried out.
 9. Methods for transporting samples to the lab, the time spent transporting the samples to the lab, and the time passed before the samples are analyzed in the lab.
 10. Analytical procedures used in the lab for each required chemical parameter, including make and model of any automated analytical equipment used. If procedures are exactly as described in published sources, references may be listed to fulfill this equipment.

- B. Because of the volatile nature of organics, special equipment shall be used and field sampling techniques followed for obtaining water for organic analysis:

1. Teflon bailers shall be used. Stainless steel bailers are less desirable because some organics may be absorbed by metal.
2. Monofilament or nylon line shall be used for lowering the bailer. Cut off the end of line each time and retie.
3. Triple rinsing of the bailer and line, using deionized distilled laboratory grade water, shall be conducted in the field between each sample location.

4. Glass vials with Teflon-lined screw-on caps shall be over filled so air bubbles are excluded and a positive meniscus is achieved. Vials should be capped immediately after being filled.
5. Emptying the bailer and filling the sample vials shall be conducted with a minimum of turbulence to avoid degassing. The use of a bottom emptying device with the bailer is recommended.
6. All samples shall be immediately stored in freezer packs and kept on ice during shipment to the laboratory.
7. One bailer blank shall be collected and analyzed during each sampling period. After the triple rinse decontamination procedure and before sampling the next well, a sample consisting of deionized, distilled water shall be passed through the bailer and collected. A travel blank shall also be analyzed.

APPENDIX A
DONOHUE BORING LOGS

DonohueEngineers & Architects
COMPUTER AIDED DESIGN/GRAPHICS

BORING LOG

SOIL BORING NO.

SITE: U.S.A.R.C. PROJECT NO. 15977.007

ON 112 B

DRILLING METHOD: Auger - Hollow Stem
 FOREMAN: Gary Wellner
 ASSISTANT: Neil
 GEOL./ENG'R: Jack Giraud
 LOG BY: J. Giraud

WATER LEVEL READINGS

DATE	TIME	DEPTH	W.D.
11-16-77	9:00	14'	S.C.R.
			A.C.R.
			MRS. A.D.
			MRS. A.D.

GROUND SURFACE ELEV.
 PHYSICAL SETTING: flat / gentle slope,
 DATE START: 11-16-77
 DATE COMPLETE:

DEPTH TO CHANGES IN STRATA IN FEET	SAMPLING DATA				USCS	SOIL DESCRIPTION	COMMENTS
	NO.	T	A	R			
	1st	2nd	3rd	N			
1					ML	dk brn soil silty clay, organic matter	
					CL	Clayey sand	
2						11	
3					CL	tan brn silty clay	
4					CL	dry fractured dry	
					CL	tan brn silty clay	
					ML	clayey silt dry	
5					CL	tan br silty clay faint lamination	
					CL	Chalky	
6					CL	tan br silty clay dry powdery	
					CL	trace gravel fine sand last tone	
7					CL	tan br silty clay	
					CL	trace mottles and co sand.	
8					CL	11	
9					CL	br lt tan silty clay	
10					CL	trace gravel round to sub rounded	
	1 55	2' 7/8"	7/8"		CL	gr brn silty clay tr. co. fraction	
					ML	moist - balls up cohesive	
11					CL	yellow brn to grey - oxidized	
					CL	silty clay with stg sand moist	
12					CL	gr brn silty clay broken rock ang.	
					CL	2-3" granule - friable L.S. wet to damp	
13					SC	Clayey Gravelly sand - grey	
					CL	angular L.S. fragments clay sand matrix	
14					CL	grey brn silty clay	
					CL	trace gravel	
15					CL	0.5' mottled clay grey. brn laminations	Calcareous
0	2 55	15' 1/4" 50/53	1/2" 40/45		SM	silty Gravelly sand - grey - broken L.S. rock	Crunchy
					SM	angular fragments dry (no moisture)	Grinding
16					SM	Sand very - Vfn medium size.	Sound
17							
18					Dry silty Clay - questionable samples		
19							
20							
21	3 55	1/2" 40/45	?		CL	1.5' grey brn clay with ang. rock fragments	
					SM	Saturated .5' sand med. fn.	Crunchy
22	3				CL	Limestone grey crystalline fractures	Angular
					CL	abundant opalite Fe ₂ O ₃ possible broken broken	Sound
23							
24					wet clay off Poor samples questionable representation round gravel in clay matrix		
25							

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DRILLING DATA

SOIL BORING NUMBER
 ADDITIONAL DRILLING DATA

Split Tube Size ID OD
 Hammer Wt. 1417 lb .10 in drop
 Thin Wall Tube Size OD
 Casing Used LF Dia.
 Casing Hammer Ib in drop
 Drill Rod Size
 Drill Bit Type (a) (b)
 Drill Bit Size (a) (b)
 Auger Type 6 1/2 OD
 Hollow Stem Auger 1/2 ID
 Core Barrel Size ID Length
 Core Bit Serial
 Core Bit Serial
 Drill Mud Type
 Drill Mud Formula
 Depth Drill Mud Used
 Back Filled Date
 Method b:
 Drill Rig Mfg. Mod.
 Other Equip
 Other Equip.

DRILLING INFORMATION

- 1 Record measurements in terms of feet.
- 2 For samples, record sample type (split spoon, shelby, core) depths, sample interval, length of sample recovered.
- 3 Record first encountered water and any other distinct water producing zones.
- 4 Record blow counts (lb-in/lv), hammer weight, length of fall for driven samples.
- 5 Record use of drilling fluid. Fluid type, source of water, fluid losses, interval (and soil type) where fluid loss occurred, if determinable, quantitative estimate of volume of fluid loss.
- 6 Record drilling equipment used and general drilling procedures.
- 7 Record all problems encountered during drilling.
- 8 Collect samples of backfill, gravel, and concrete.
- 9 Report general drilling conditions (temperature, raining, etc.)

Soil/Rock Description Requirements

- | | |
|--|---|
| 1 | Soil |
| a | Written classification |
| b | USCS symbol |
| c | Estimated % of secondary components (% and size gravel, cobbles) |
| d | Color, moistening |
| e | Plasticity (general) |
| f | Consistency (cohesive) or density (in-cohesive) |
| g | Moisture |
| h | Texture/texture/bonding |
| i | Depositional environment |
| | |
| 2 | Rock |
| a | Classification |
| b | Lithologic characteristics |
| c | Bedding/banding |
| d | Color |
| e | Hardness |
| f | Degree of cementation |
| g | Texture |
| h | Structure |
| i | Degree of weathering |
| j | Solution or void conditions |
| k | Primary and secondary estimated hydraulic conductivity, rationale |
| Note: natural and coring induced rock breaks, and lost core including probable reason for. Include number of fractures per foot, number of fractures per total length of recovery. | |

Texture	Abbreviation	Size	Abbreviation	Soil Particle Size
Boulder	Bo			Over 3.0"
Gravel	Gr	Large	L	1.0" to 3.0"
		Medium	M	.38" to .99"
		Small	Sm	.20mm to .38"
Sand	S	Coarse	Co	.75mm to 1.99mm
		Medium	M	.25mm to .74mm
		Fine	F	.05mm to .24mm
Silt	Si			.002mm to .049mm
Clay	C			Smaller than .022mm

Consistency	Abbreviation	N	Density	Abbreviation	N
Very Soft	VS	0-2	Very Loose	VL	0-4
Soft	S	3-4	Loose	L	5-9
Medium	M	5-8	Medium Dense	MD	10-29
Stiff	St	9-16	Dense	D	30-49
Very Stiff	VST	17-30	Very Dense	VD	50+
Hard	H	Over 30			

% of Dry Weight	Term	Abbreviation
0-10	Trace or Occasional	TR or OC
11-20	Little	LI
21-35	Some	SO
36-50	And or With	& or W/

CONDITIONS FOR USE OF SOIL BORING LOG

This field soil boring log records the soil descriptions and other data observed or measured in the field by qualified soil technicians. The soils between the samples may have been determined by the "feel" of the drill bit or wash cuttings. The changes between the soil strata may be transitional rather than abrupt, particularly with respect to color, weathering, and consistency changes. The amount of large sized gravel or boulders is generally estimated because the sampling tubes seldom retain these larger sized soil particles. Delayed readings of ground water levels may not be entered on this field log.

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SHEET OF SOIL BORING NUMBER **DRILLING DATA****ADDITIONAL DRILLING DATA**

Split Tube Size ID OD
 Hammer Wt. 140 lb 30 in drop
 Thin Wall Tube Size OD
 Casing Used LF Dia.
 Casing Hammer lb in drop
 Drill Rod Size
 Drill Bit Type (a) (b)
 Drill Bit Size (a) (b)
 Auger Type 6 3/4 OD
 Hollow Stem Auger 4 1/2 ID
 Core Barrel Size ID Length
 Core Bit Serial
 Core Bit Serial
 Drill Mud Type
 Drill Mud Formula
 Depth Drill Mud Used
 Back Filled Date
 Method by
 Drill Rig Mfg. Mod.
 Other Equip.
 Other Equip.

DRILLING INFORMATION

1. Record measurements in terms of feet.
2. For samples, record sample type (split spoon, shelby, core) depths, sample interval, length of sample recovered.
3. Record first encountered water and any other distinct water producing zones.
4. Record blow counts (density), hammer weight, length of fall for driven samples.
5. Record use of drilling fluids, fluid type, source of water, fluid losses, interval (and soil type) where fluid loss occurred, if determinable, quantitative estimate of volume of fluid loss.
6. Record drilling equipment used and general drilling procedures.
7. Record all problems encountered during drilling.
8. Collect samples of backfill, grout, and concrete.
9. Report general drilling conditions. (temperature, raining, etc.)

Soil/Rock Description Requirements

- | | |
|---|---|
| 1 | Soil |
| | a. Written classification
b. USCS symbol
c. Estimated % of secondary components (% and size gravel, cobbles)
d. Color, matting
e. Plasticity (general)
f. Consistency (cohesive) or density (in-cohesive)
g. Moisture
h. Texture/grain/binding
i. Depositional environment |
| 2 | Rock |
| | a. Classification
b. Lithologic characteristics
c. Bedding/bonding
d. Color
e. Hardness
f. Degree of cementation
g. Texture
h. Structure
i. Degree of weathering
j. Solution or void conditions
k. Primary and secondary estimated hydraulic conductivity, rationale
Note natural and coring induced rock breaks, and lost core including probable reason for. Include number of fractures per foot, number of fractures per total length of recovery. |

<u>Texture</u>	<u>Abbreviation</u>	<u>Size</u>	<u>Abbreviation</u>	<u>Soil Particle Size</u>
Boulder	Bo			Over 3.0"
Gravel	Gr	Large Medium Small	L M Sm	1.0" to 3.0" .38" to .99" 2.0mm to .38"
Sand	S	Coarse Medium Fine	Co M F	.75mm to 1.99mm .25mm to .74mm .05mm to .24mm
Silt	Si			.002mm to .049mm
Clay	C			Smaller than .022mm

<u>Consistency</u>	<u>Abbreviation</u>	<u>N</u>	<u>Density</u>	<u>Abbreviation</u>	<u>N</u>
Very Soft	VS	0-2	Very Loose	VL	0-4
Soft	S	3-4	Loose	L	5-9
Medium	M	5-8	Medium Dense	MD	10-29
Stiff	St	9-16	Dense	D	30-49
Very Stiff	VST	17-30	Very Dense	VD	50+
Hard	H	Over 30			

<u>% of Dry Weight</u>	<u>Term</u>	<u>Abbreviation</u>
0-10	Trace or Occasional	TR or OC
11-20	Little	L1
21-35	Some	SO
36-50	And or With	& or W/

CONDITIONS FOR USE OF SOIL BORING LOG

This field soil boring log records the soil descriptions and other data observed or measured in the field by qualified soil technicians. The soils between the samples may have been determined by the "feel" of the drill bit or wash cuttings. The changes between the soil strata may be transitional rather than abrupt, particularly with respect to color, weathering, and consistency changes. The amount of large sized gravel or boulders is generally estimated because the sampling tubes seldom retain these larger sized soil particles. Delayed readings of ground water levels may not be entered on this field log.

Donohue

Engineers & Architects

SHEET OFSOIL BORING NUMBER **DRILLING DATA****ADDITIONAL DRILLING DATA**

Split Tube Size ID OD
 Hammer Wt. 140 lb 30 in drop
 Thin Wall Tube Size OD
 Casing Used LF Dia.
 Casing Hammer lb in drop
 Drill Rod Size
 Drill Bit Type (a) (b)
 Drill Bit Size (a) (b)
 Auger Type 6" OD
 Hollow Stem Auger 4" ID
 Core Barrel Size ID Length
 Core Bit Serial
 Core Bit Serial
 Drill Mud Type
 Drill Mud Formula
 Depth Drill Mud Used
 Back Filled Date
 Method by
 Drill Rig Mfg. Mod.
 Other Equip
 Other Equip.

DRILLING INFORMATION

1. Record measurements in units of feet.
2. For samples, record sample type (split spoon, shaly, core) depth, sample interval, length of sample recovered.
3. Record first encountered water and any other distinct water producing zones.
4. Record blow counts (density), hammer weight, length of fall for driven samples.
5. Record use of drilling fluids, fluid type, source of water, fluid losses, interval (and soil type) where fluid loss occurred, if determinable, quantitative estimate of volume of fluid loss.
6. Record drilling equipment used and general drilling procedures.
7. Record all problems encountered during drilling.
8. Collect samples of boulders, gravel, and cobbles.
9. Report general drilling conditions; (temperature, raining, etc.)

Soil/Rock Description Requirements

1. **Soil**
 - a. Written identification
 - b. USCS symbol
 - c. Estimated % of secondary components (% and size gravel, cobbles)
 - d. Color, moisture
 - e. Plasticity (general)
 - f. Consistency (cohesive) or density (in-cohesive)
 - g. Measure
 - h. Temperature/texture
 - i. Depositional environment
2. **Rock**
 - a. Classification
 - b. Lithologic characteristics
 - c. Bedding/banding
 - d. Color
 - e. Hardness
 - f. Degree of cementation
 - g. Texture
 - h. Structure
 - i. Degree of weathering
 - j. Solution or void conditions
 - k. Primary and secondary estimated hydraulic conductivity, rationale
 - l. Most natural and coring induced rock breaks, and lost core including probable reason for. Include number of fractures per foot, number of fractures per total length of recovery.

<u>Texture</u>	<u>Abbreviation</u>	<u>Size</u>	<u>Abbreviation</u>	<u>Soil Particle Size</u>
Boulder	Bo			Over 3.0"
Gravel	Gr	Large	L	.10" to 3.0"
		Medium	M	.38" to .99"
		Small	Sm	.20mm to .38"
Sand	S	Coarse	Co	.75mm to 1.99mm
		Medium	M	.25mm to .74mm
		Fine	F	.05mm to .24mm
Silt	Si			.002mm to .049mm
Clay	C			Smaller than .022mm

<u>Consistency</u>	<u>Abbreviation</u>	<u>N</u>	<u>Density</u>	<u>Abbreviation</u>	<u>N</u>
Very Soft	VS	0-2	Very Loose	VL	0-4
Soft	S	3-4	Loose	L	5-9
Medium	M	5-8	Medium Dense	MD	10-29
Stiff	St	9-16	Dense	D	30-49
Very Stiff	VST	17-30	Very Dense	VD	50+
Hard	H	Over 30			

<u>% of Dry Weight</u>	<u>Term</u>	<u>Abbreviation</u>
0-10	Trace or Occasional	TR or OC
11-20	Little	LI
21-35	Some	SO
36-50	And or With	& or W/

CONDITIONS FOR USE OF SOIL BORING LOG

This field soil boring log records the soil descriptions and other data observed or measured in the field by qualified soil technicians. The soils between the samples may have been determined by the "feel" of the drill bit or wash cuttings. The changes between the soil strata may be transitional rather than abrupt, particularly with respect to color, weathering, and consistency changes. The amount of large sized gravel or boulders is generally estimated because the sampling tubes seldom retain these larger sized soil particles. Delayed readings of ground water levels may not be entered on this field log.

Donohue

BORING LOG

SOIL BORING NO.

Engineers & Architects

SITE: U.S.A.R.C. PROJECT NO. 15977.007
November 14, 1988

dw-113 B

November 14, 1988

DRILLING METHOD: Auger - Hollow Stem
FOREMAN: Gary Wellner
ASSISTANT: Neil
GEOL./ENG'R: Joel Giraud
LOG BY: St. Giraud

WATER LEVEL READINGS			
DATE	TIME	DEPTH	
11-14	3:30	14.31	W.C.
11-14	4:25	14.77	S.C.R.
11-15	4:45 AM	9.82	A.C.R.
11-15	10:00 PM	8.92	H.P.S. A.D.
11-16	2:15 AM	8.92	H.P.S. A.D.

GROUND SURFACE ELEV. _____
PHYSICAL SETTING: flat / low L
DATE START: 11-14-84
DATE COMPLETE: 11-14-84

DEPTH TO CHANGES IN STRATA	DEPTH IN FEET	SAMPLING DATA				USCS	SOIL DESCRIPTION	COMMENTS
		NO.	T	A	R			
1						ML	dk brown clayey sand - 10% silt, moist	
2						ML	brown silty sand, red gravel to cobbles & 1 depth. limestone	calcareous material
3						ML	lt brown silty sand - < 5% gravel round to sub-ang. dry / chalky.	
4						ML	lt brown silty sand, vfn sand no co. fraction, dry	
5						ML	lt brown silty sand - 10-20% clay	
6						ML	gray brn. clayey sand - wells up	
7						CL	sandy silty clay. gray brn sand-fine < 5% silt. trace moisture	
8						CL	gray brn silty clay	
9						CL	gray brn clayey silt tr. go. and sand tr round granules. wet/moist.	easier drilling at ~ 9'
10						CL	gray brn silty clay tr. med. fine sand trace granules	? Water table
11	1 SS	1' 4/5 7/15				CL	gray sandy silty clay fn-med sand trace fine gravel and ang. moist	gravelly crunchy drilling
12	1 SS					CL	gr sand - 1" recovery calcareous	
13						CL	gr silty clay	
14						CL	gr sandy silty clay muddy cuttings - very fluid	easier drilling 13-15'
15						CL	gr silty clay muddy - very fluid	
16						CL	gr silty sandy clay	
17	2 SS	2' 4/5 7/15				SM	gr silty gravelly sand carbonaceous sand tr. siliceous sand, saturated, ang. limestone, coarse sand	Crunchy at base
18	2 SS					SM	" "	
19						CL	gr silty sand muddy top anger flight - non representative.	
20						Clayey	Saturated	
						Clayey	Saturated	
						Advanced borehole to 20'. Clays swelling in anger - flushed with clean water to remove cuttings.		
						Based on water level set 10-11' decided to place screen spans 8 to 18'.		

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DRILLING DATASHEET OF **SOIL BORING NUMBER** **ADDITIONAL DRILLING DATA**

Split Tube Size ID OD
 Hammer Wt. 170 lb .30 in drop
 Thin Wall Tube Size OD
 Casing Used LF Dis.
 Casing Hammer lb in drop
 Drill Rod Size
 Drill Bit Type (a) (b)
 Drill Bit Size (a) (b)
 Auger Type 6 1/2 OD
 Hollow Stem Auger 4 ID
 Core Barrel Size ID Length
 Core Bit Serial
 Core Bit Serial
 Drill Mud Type
 Drill Mud Formula
 Depth Drill Mud Used
 Back Filled Date
 Method by
 Drill Rig Mfg. Mod.
 Other Equip
 Other Equip.

DRILLING INFORMATION

1. Record measurements in units of feet.
2. For samples, record sample type (unit spear, shelly, core) depth, sample interval, length of sample recovered.
3. Record first encountered water and any other distinct water producing zones.
4. Record blow counts (density), hammer weight, length of fall for driven samples.
5. Record use of drilling fluids, fluid type, source of water, fluid losses, interval (and soil type) where fluid loss occurred, if determinable, quantitative estimate of volume of fluid lost.
6. Record drilling equipment used and general drilling procedures.
7. Record all problems encountered during drilling.
8. Collect samples of backfill, gravel, and concrete.
9. Report general drilling conditions: (temperature, raining, etc.)

Soil/Rock Description Requirements

1. Soil
 - a. Wet soil classification
 - b. USCS symbol
 - c. Estimated % of secondary components (% and size gravel, cobbles, etc.)
 - d. Color, mottling
 - e. Plasticity (general)
 - f. Consistency (cohesive) or density (non-cohesive)
 - g. Mass
 - h. Temperature/Testing
 - i. Depositional environment
2. Rock
 - a. Classification
 - b. Lithologic characteristics
 - c. Bonding/banding
 - d. Color
 - e. Hardness
 - f. Degree of cementation
 - g. Texture
 - h. Structures
 - i. Degree of weathering
 - j. Solution or void conditions
 - k. Primary and secondary estimated hydraulic conductivity, resistance
 - l. Rock nature and setting induced rock breaks, and lost core including probable reason for. Include number of fractures per foot, number of fractures per total length of recovery.

<u>Texture</u>	<u>Abbreviation</u>	<u>Size</u>	<u>Abbreviation</u>	<u>Soil Particle Size</u>
Boulder	Bo			Over 3.0"
Gravel	Gr	Large	L	.1.0" to 3.0"
		Medium	M	.38" to .98"
		Small	Sm	.20mm to .38"
Sand	S	Coarse	Co	.75mm to 1.99mm
		Medium	M	.25mm to .74mm
		Fine	F	.05mm to .24mm
Silt	Si			.002mm to .049mm
Clay	C			Smaller than .022mm

<u>Consistency</u>	<u>Abbreviation</u>	<u>N</u>	<u>Density</u>	<u>Abbreviation</u>	<u>N</u>
Very Soft	VS	0-2	Very Loose	VL	0-4
Soft	S	3-4	Loose	L	5-9
Medium	M	5-8	Medium Dense	MD	10-29
Stiff	St	9-16	Dense	D	30-49
Very Stiff	VST	17-30	Very Dense	VD	50+
Hard	H	Over 30			

<u>% of Dry Weight:</u>	<u>Term</u>	<u>Abbreviation</u>
0-10	Trace or Occasional	TR or OC
11-20	Little	LI
21-35	Some	SO
36-50	And or With	& or W/

CONDITIONS FOR USE OF SOIL BORING LOG

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Donohue

Engineers & Architects
Computer Aided Design/Drafting

BORING LOG

SOIL BORING NO.

SITE: U.S.A.R.C. PROJECT NO. 15977.007

(P113) A

DRILLING METHOD: Auger - Hollow Stem
FOREMAN: Gary Wellner
ASSISTANT: Neil
GEOL./ENG'R: Joel Giraud
LOG BY: J. Giraud

WATER LEVEL READINGS

DATE	TIME	DEPTH	R.D.
			S.C.R.
			A.C.R.
			HRS. A.D.
			HRS. A.D.

GROUND SURFACE ELEV. _____
PHYSICAL SETTING: flat/gentle slope
DATE START: 11-15-88
DATE COMPLETE: 11-16-88

DEPTH TO CHANGES IN STRATA IN FEET ft	TEST NO. #	SAMPLING DATA				USCS	SOIL DESCRIPTION	COMMENTS
		N	T	A	R			
			1st	2nd	3rd	N		
1	1 ss	2' 6 1/8					dk brown loamy clay rich soil clayey sand / sandy clay fine sand	
2	1 ss						dk brown silty clayey sand moist - roots/organic matter.	
3								
4								
5								
6	2 ss	3' 3 1/3					yellow br - rusty - mottled clayey sandy silt sand is rfn	
7	2 ss						brn. silty-clayey sand cr-vfn brown fine sand gravel - rnd to sub rnd	
8								
9								
10	3 ss	2' 5 10/13					lt brn sandy silty clay - very saturated	
11	3 ss						gr sandy clay / clayey sand gravelly sand gravel to med sand - calcareous, saturated	Gravel between Clay + Sand
12								
13								
14								
15								
16								
17								
18								
19								
20	4 ss	2' 17 19/13					gray vgo-fn sand - calcareous fb to gravel. angular calcite fr. fragments 2nd also	
21	4						gr brown silty clay moist - not saturated.	
22								
23								
24								
25								
26	5 ss	2' 5 17/13					cl gr silty clay - very dense/stiff moist	
27	5						gray silty clay - faint laminations (mixed) calcareous	

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SHEET OF **DRILLING DATA****SOIL BORING NUMBER** **ADDITIONAL DRILLING DATA**

Split Tube Size ID OD
 Hammer Wt. 140 lb .30 in drop
 Thin Wall Tube Size OD
 Casing Used LF Dia.
 Casing Hammer lb in drop
 Drill Rod Size
 Drill Bit Type (a) (b)
 Drill Bit Size (a) (b)
 Auger Type 6" OD
 Hollow Stem Auger .50 ID
 Core Barrel Size ID Length
 Core Bit Serial
 Core Bit Serial
 Drill Mud Type
 Drill Mud Formula
 Depth Drill Mud Used
 Back Filled Date
 Method by
 Drill Rig Mfg. Mod. COKSS
 Other Equip
 Other Equip

DRILLING INFORMATION

1. Record measurements in terms of feet.
2. For samples, record sample type (soft, open, shaly, core) depth, sample interval, length of sample recovered.
3. Record first encountered water and any other distinct water producing zones.
4. Record blow counts (density), hammer weight, length of fall for driven samples.
5. Record use of drilling fluids, fluid type, source of water, fluid losses, interval (and soil type) where fluid loss occurred, if determinable, quantitative estimate of volume of fluid lost.
6. Record drilling equipment used and general drilling procedures.
7. Record all problems encountered during drilling.
8. Collect samples of backfill, gravel, and concrete.
9. Report general drilling conditions: (temperature, relative, etc.)

Soil/Rock Description Requirements

1. **Soil**
 - a. Written classification
 - b. USCS symbol
 - c. Estimated % of secondary components (% sand and silt gravel, cobbles)
 - d. Color, mottling
 - e. Plasticity (general)
 - f. Consistency (cohesive) or density (non-cohesive)
 - g. Moisture
 - h. Temperature/Insulating
 - i. Depositional environment
2. **Rock**
 - a. Classification
 - b. Lithologic characteristics
 - c. Bedding/banding
 - d. Color
 - e. Hardness
 - f. Degree of cementation
 - g. Texture
 - h. Structure
 - i. Degree of weathering
 - j. Solution or void conditions
 - k. Primary and secondary estimated hydraulic conductivity, retentive
 - l. Note natural and coring induced rock breaks, and lost core including probable reason for. Include number of fractures per foot, number of fractures per total length of recovery.

<u>Texture</u>	<u>Abbreviation</u>	<u>Size</u>	<u>Abbreviation</u>	<u>Soil Particle Size</u>
Boulder	Bo			Over 3.0"
Gravel	Gr	Large	L	1.0" to 3.0"
		Medium	M	.38" to .99"
		Small	Sm	.20mm to .38"
Sand	S	Coarse	Co	.75mm to 1.99mm
		Medium	M	.25mm to .74mm
		Fine	F	.05mm to .24mm
Silt	Si			.002mm to .048mm
Clay	C			Smaller than .022mm

<u>Consistency</u>	<u>Abbreviation</u>	<u>N</u>	<u>Density</u>	<u>Abbreviation</u>	<u>N</u>
Very Soft	VS	0-2	Very Loose	VL	0-4
Soft	S	3-4	Loose	L	5-9
Medium	M	5-8	Medium Dense	MD	10-29
Stiff	St	9-16	Dense	D	30-49
Very Stiff	VST	17-30	Very Dense	VD	50+
Hard	H	Over 30			

<u>% of Dry Weight</u>	<u>Term</u>	<u>Abbreviation</u>
0-10	Trace or Occasional	TR or OC
11-20	Little	LI
21-35	Some	SO
36-50	And or With	& or W/

CONDITIONS FOR USE OF SOIL BORING LOG

This field soil boring log records the soil descriptions and other data observed or measured in the field by qualified soil technicians. The soils between the samples may have been determined by the "feel" of the drill bit or wash cuttings. The changes between the soil strata may be transitional rather than abrupt, particularly with respect to color, weathering, and consistency changes. The amount of large sized gravel or boulders is generally estimated because the sampling tubes seldom retain these larger sized soil particles. Delayed readings of ground water levels may not be entered on this field log.

Donohue

Engineers & Architects
Computer Aided Engineering Services

BORING LOG

SOIL BORING NO.

SITE: U.S.A.R.C PROJECT NO. 15977.007

(P-113)

DRILLING METHOD: Auger - Hollow Stem
FOREMAN: Gary Wellner
ASSISTANT: Neil
GEOL./ENG'R: Joel Girard
LOC BY: J. Girard

WATER LEVEL READINGS			
DATE	TIME	DEPTH	W.D.
			S.C.R.
			A.C.R.
			H.P.E. A.D.
			H.P.E. A.D.

GROUND SURFACE ELEV. _____
PHYSICAL SETTING: flat/gentle slopes
DATE START: 11-15-88
DATE COMPLETE: 11-16-88

DEPTH TO CHANGES IN STRATA IN FEET W.F.	SAMPLING DATA				USCS	SOIL DESCRIPTION	COMMENTS
	N	T	A	R			
-	-	-	-	-			
-	-	-	-	-			
27'	-	-	-	-			
44'	-	-	-	-			
45'	-	-	-	-			
46'	-	-	-	-			
47'	-	-	-	-			
48'	6.83	2' 7/8	13 1/8		CL	gr to brn gray clay trace silt very plastic	
49'	6				CL	gr to brn gray clay	
50'	-	-	-	-			
51'	-	-	-	-			
52'	-	-	-	-			
53'	-	-	-	-			
54'	-	-	-	-			
55'	-	-	-	-			
56'	-	-	-	-			
57'	-	-	-	-			
58'	-	-	-	-			
59'	-	-	-	-			
60'	-	-	-	-			
61'	-	-	-	-			
62'	-	-	-	-			
63'	-	-	-	-			
64'	-	-	-	-			
65'	-	-	-	-			
66'	-	-	-	-			
67'	7.55	1' 22/3			SP	brn gray med sand, well sorted saturated cl. O.S.	
68'	7				CL	clay bottom @ 9.5' gray to brn gray med sand @ 41'	
69'	-	-	-	-			
70'	-	-	-	-			
71'	-	-	-	-			
72'	-	-	-	-			
73'	-	-	-	-			
74'	-	-	-	-			
75'	-	-	-	-			
76'	-	-	-	-			
77'	-	-	-	-			
78'	-	-	-	-			
79'	-	-	-	-			
80'	-	-	-	-			
81'	-	-	-	-			
82'	-	-	-	-			
83'	-	-	-	-			
84'	-	-	-	-			
85'	8.55	.5 sq				Clay recovery - no giving, possibly bedrock	
86'	-	-	-	-			
87'	-	-	-	-			
88'	-	-	-	-			
89'	-	-	-	-			
90'	-	-	-	-			
91'	-	-	-	-			
92'	-	-	-	-			
93'	-	-	-	-			
94'	-	-	-	-			
95'	-	-	-	-			

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DRILLING DATASHEET OF
SOIL BORING NUMBER **ADDITIONAL DRILLING DATA**

Split Tube Size ID OD
 Hammer Wt. 140 lb 20 in drop
 Thin Wall Tube Size OD
 Casing Used LF Dia.
 Casing Hammer lb in drop
 Drill Rod Size
 Drill Bit Type (a) (b)
 Drill Bit Size (a) (b)
 Auger Type OD
 Hollow Stem Auger 2ID
 Core Barrel Size 4/4 ID Length
 Core Bit Serial
 Core Bit Serial
 Drill Mud Type
 Drill Mud Formula
 Depth Drill Mud Used
 Back Filled Date
 Method UV
 Drill Rig Mfg. Mod.
 Other Equip
 Other Equip.

DRILLING INFORMATION

1. Record measurements in units of feet.
2. For samples, record sample type (split spoon, shaly, core) depth, sample interval, length of sample recovered.
3. Record first encountered water and any other distinct water producing zones.
4. Record blow counts (density), hammer weight, length of fall for driven samples.
5. Record use of drilling fluid, fluid type, source of water, fluid losses, interval (and soil type) where fluid loss occurred, if determinable, quantitative estimate of volume of fluid loss.
6. Record drilling equipment used and general drilling procedures.
7. Collect samples of boulders, gravel, and concrete.
8. Report general drilling conditions, (temperature, raining, etc.)

Soil/Rock Description Requirements

1. Soil
 - a. Grained classification
 - b. USCS symbol
 - c. Estimated % of secondary components (% sand gravel, cobbles)
 - d. Color, weathering
 - e. Plasticity (general)
 - f. Consistency (loose/soft) or density (non-cohesive)
 - g. Measure
 - h. Testwork/Testing
 - i. Depositional environment
2. Rock
 - a. Classification
 - b. Lithologic characteristics
 - c. Bedding/bonding
 - d. Color
 - e. Hardness
 - f. Degree of weathering
 - g. Texture
 - h. Structure
 - i. Degree of weathering
 - j. Solution or void conditions
 - k. Primary and secondary uniaxial hydraulic conductivity, resistance
 - l. Note natural and coring induced rock breaks, and test core including probable reason for. Include number of fractures per foot, number of fractures per total length of recovery.

<u>Texture</u>	<u>Abbreviation</u>	<u>Size</u>	<u>Abbreviation</u>	<u>Soil Particle Size</u>
Boulder	Bo			Over 3.0"
Gravel	Gr	Large	L	.1.0" to 3.0"
		Medium	M	.38" to .99"
		Small	Sm	.2.0mm to .38"
Sand	S	Coarse	Co	.75mm to 1.99mm
		Medium	M	.25mm to .74mm
		Fine	F	.05mm to .24mm
Silt	Si			.002mm to .049mm
Clay	C			Smaller than .022mm

<u>Consistency</u>	<u>Abbreviation</u>	<u>N</u>	<u>Density</u>	<u>Abbreviation</u>	<u>N</u>
Very Soft	VS	0-2	Very Loose	VL	0-4
Soft	S	3-4	Loose	L	5-9
Medium	M	5-8	Medium Dense	MD	10-29
Stiff	St	9-16	Dense	D	30-49
Very Stiff	VST	17-30	Very Dense	VD	50+
Hard	H	Over 30			

<u>% of Dry Weight</u>	<u>Term</u>	<u>Abbreviation</u>
0-10	Trace or Occasional	TR or OC
11-20	Little	LI
21-35	Somewhat	SO
36-50	And or With	& or W/

CONDITIONS FOR USE OF SOIL BORING LOG

This field soil boring log records the soil descriptions and other data observed or measured in the field by qualified soil technicians. The soils between the samples may have been determined by the "feel" of the drill bit or wash cuttings. The changes between the soil strata may be transitional rather than abrupt, particularly with respect to color, weathering, and consistency changes. The amount of large sized gravel or boulders is generally estimated because the sampling tubes seldom retain these larger sized soil particles. Delayed readings of ground water levels may not be entered on this field log.

APPENDIX B
TWIN CITY TESTING BORING LOGS

LOG OF TEST BORING

JOB NO. - 8100-89-0181

VERTICAL SCALE 1" = 6'

BOILING NO. OW112B

PROJECT MW INSTALLATION PROJECT, DEPARTMENT OF THE ARMY, MILWAUKEE, WISCONSIN

WATER LEVEL MEASUREMENTS

START 11-17-88 COMPLETE 11-17-88

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD	13:55
11-18	13:00	--	--	--	to	18.0		
					to			
					to			
					to			
							CREW CHIEF	WELLNER

LOG OF TEST BORING

JOB NO.		PROJECT		VERTICAL SCALE	1" = 6'	BORING NO.		P112A						
DEPTH IN FEET	DESCRIPTION OF MATERIAL			GEOLOGIC ORIGIN	N	WL	NO.	SAMPLE	LABORATORY TESTS					
	SURFACE ELEVATION 691.76						NO.	TYPE	W	D	LL PL	Qu		
12"	ORGANIC SILT, black (OL)			TOPSOIL			1	A						
	LEAN CLAY, yellowish brown, stiff (CL)			FINE ALLUVIUM			2	A						
						25	3	SB						
8½	LEAN CLAY, with (See #1)													
9	SILTY CLAY, with gravel, cobbles, brown to gray, stiff (CL-ML)					21	4	SB						
15	SAND, with gravel, medium grained, gray, moist, very dense (SM)			COARSE ALLUVIUM	43		5	SB						
20	SAND, with gravel, cobbles, gray, waterbearing, very dense, layers of sandy lean clay (SP)				44		5	SB						
25	SAND, with gravel, medium to coarse grained, gray, dense to very dense, layers of silty sand (SP)				27		7	SB						
						32	8	SB						
							35	9	SB					
							33	10	SB					
43	SILTY SAND, with gravel, gray, waterbearing, very dense (SM)					30								
45½	END OF BORING					0.5		11	SB					
	#1 gravel, cobbles, brown, stiff (CL)													

WATER LEVEL MEASUREMENTS

START 11-22-88 COMPLETE 11-23-88

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD	09:30
11-22	15:53	21½'	20'	21½'	to	18½'		
					to			
					to			
					to			
							CREW CHIEF	WELLNER

LOG OF TEST BORING

JOB NO. 8100-89-0181 VERTICAL SCALE 1" = 6' BORING NO OW113B
 PROJECT MW INSTALLATION PROJECT, DEPARTMENT OF THE ARMY, MILWAUKEE, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
					NO.	TYPE	W	D	L.L. P.L.	Qu
6"	SURFACE ELEVATION <u>679.94</u>	TOPSOIL								
6"	ORGANIC SILTY CLAY, dark brown (OL)									
6"	SILTY SAND, light brown, moist (SM)	COARSE ALLUVIUM								
6"	SILTY CLAY, brown (CL-ML)	FINE ALLUVIUM								
10	SILTY SAND, with gravel, gray, wet, meidum dense (SM)	COARSE ALLUVIUM	12		1	SB				
10					2	SB				
15	SAND, medium grained, gray, water-bearing, loose (SP)		7		3	SB				
17	SILTY CLAY, with gravel, gray (CL-ML)	FINE ALLUVIUM								
20	END OF BORING									

WATER LEVEL MEASUREMENTS							START <u>11-14-88</u>	COMPLETE <u>11-15-88</u>
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD	08:30
11-14	16:35	17'	19'	19'	10	12'	4 ¹ / ₄ " HSA 0' to 20'	
11-15	07:00	20'	20'	20'	10	9 ¹ / ₂ '		
					10			
					10		CREW CHIEF	WELLNER

LOG OF TEST BORING

JOB NO. 8100-89-0181 VERTICAL SCALE 1" = 6' BORING NO P113A
 PROJECT MW INSTALLATION PROJECT, DEPARTMENT OF THE ARMY, MILWAUKEE, WISCONSIN

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS			
					NO	TYPE	W	D	LL P.L.	Qu
	SURFACE ELEVATION <u>679.98</u>									
9"	ORGANIC LEAN CLAY, dark brown (OL)	TOPSOIL			1	SB				
	ORGANIC LEAN CLAY, dark brown (OL)	FINE ALLUVIUM	8		2	SB				
2	SILTY SAND, with gravel, light brown to brown, moist, loose (SM)	COARSE ALLUVIUM								
7	SILTY CLAY, with sand, brown, medium (CL-ML)	FINE ALLUVIUM	6	▼	3	SB				
11	SAND, with gravel, (See #1)	COARSE ALLUVIUM								
11½	CLAYEY SAND, with gravel, (See #2)		18		4	SB				
12	SILTY CLAY, with gravel, gray, stiff, layers of sand (CL-ML)	FINE ALLUVIUM								
20	SAND, with gravel, medium to coarse grained, gray, wet, dense (SP)	COARSE ALLUVIUM			5	SB				
21½	GRAVELLY LEAN CLAY, gray, very stiff (CL)	FINE ALLUVIUM	38		6	SB				
22	SILTY CLAY, with sand, gray, very stiff (CL-ML)									
25	LEAN CLAY, a little gravel, grayish brown, very stiff (CL)				31	7	SB			
					26	8	SB			
40	SANDY SILTY CLAY, a little gravel, gray, very stiff (CL-ML)				55 0.5'	9	SB			
						10	SB			
45	END OF BORING #1 coarse grained, gray, wet, dense (SP) #2 gray, wet, dense (SC)				50 0.5'	11	SB			

WATER LEVEL MEASUREMENTS

START 11-15-88 COMPLETE 11-15-88

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE IN DEPTH	BAILED DEPTHS	WATER LEVEL	METHOD		CREW CHIEF	WELLNER
							14:15	4½" HSA 0' to 45'		
11-18	9:30	--	--	--	10	8.2'				
					10					
					10					
					10					

APPENDIX C

DONOHUE WELL CONSTRUCTION DIAGRAMS

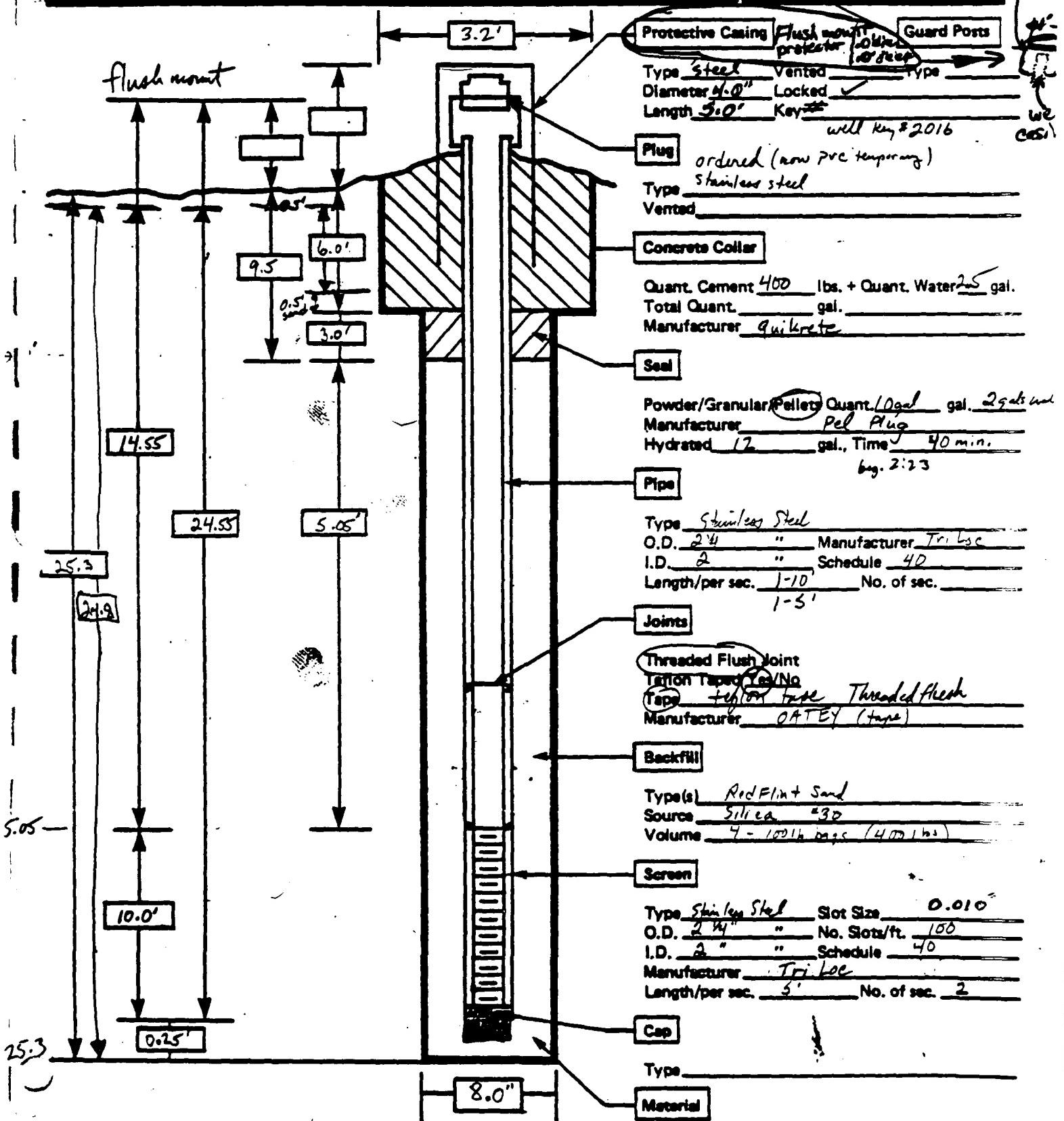
X-section
 ground surface
 flush mount
 concrete
 0.5' vent
 flush mount protector
 concrete
 concrete

Sheet _____ of _____

Donohue

OBSERVATION WELL INSTALLATION DIAGRAM
 Site: USARC Training Area Date: 11/17/98
 By: Jeff Anderson Project No. 15977.007

Well No. OW-112A offset flush probe
 offset



Notes: Water Source Original OW-112A was abandoned

since driller's metal measuring device was lost in the borehole. Offset 4.5' NW upgrade/dt from abandoned hole

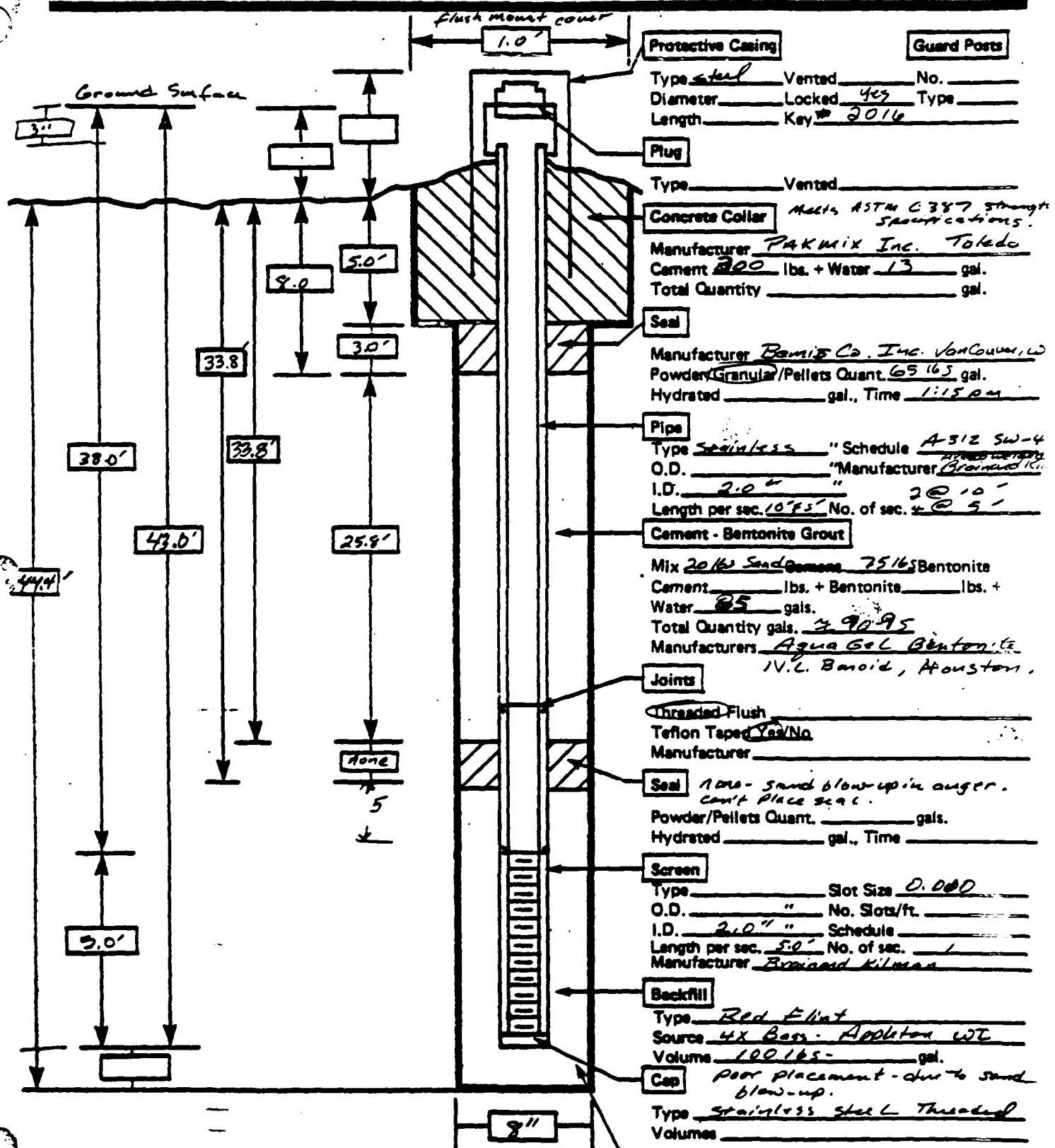
Denohue

PIEZOMETER INSTALLATION DIAGRAM

Site: P-1124 U.S.A.R.C. Date: 11-23-88
By: J. Giread Project No. 15777.007

Sheet / of /

Well No. P-112-4



Notes: Water Source

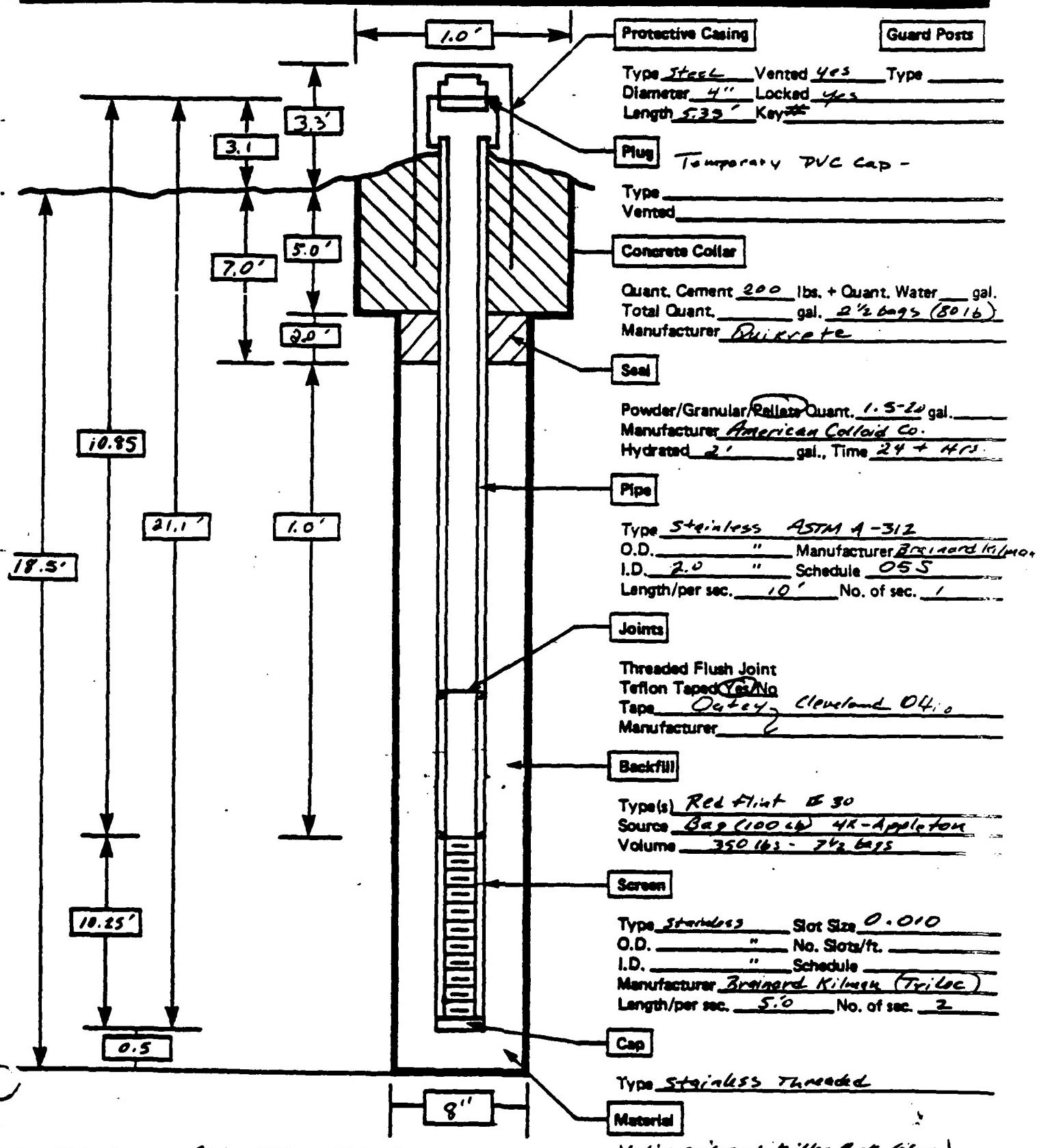
U.S.A.R.C. - clean potable water Bldg 312

Donohue

OBSERVATION WELL INSTALLATION DIAGRAM

Site: USARC (Milwaukee) Date: 11-15-58
By: Jack Gireau Project No. 15977.007

Well No. 02-113 B

Notes: Water Source Bldg. 312 USARC

Potable water

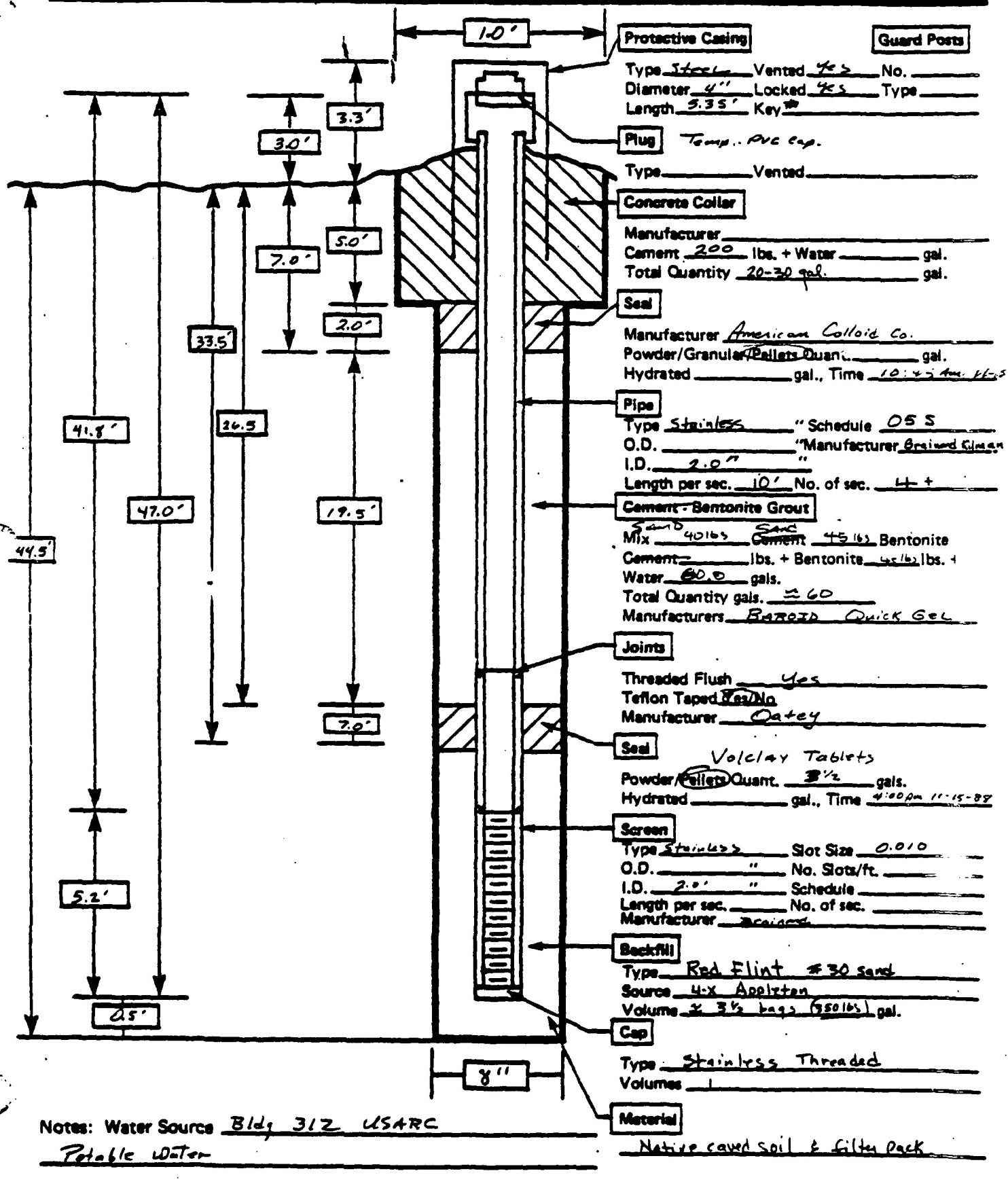
Donohue

PIEZOMETER INSTALLATION DIAGRAM

Site: USARC Training Area Date: 11-15/86 - 88
By: J. Girard Project No. 15927.007

Sheet 1 of 1

Well No. P-163 A



APPENDIX D

TWIN CITY TESTING
WELL CONSTRUCTION DIAGRAMS

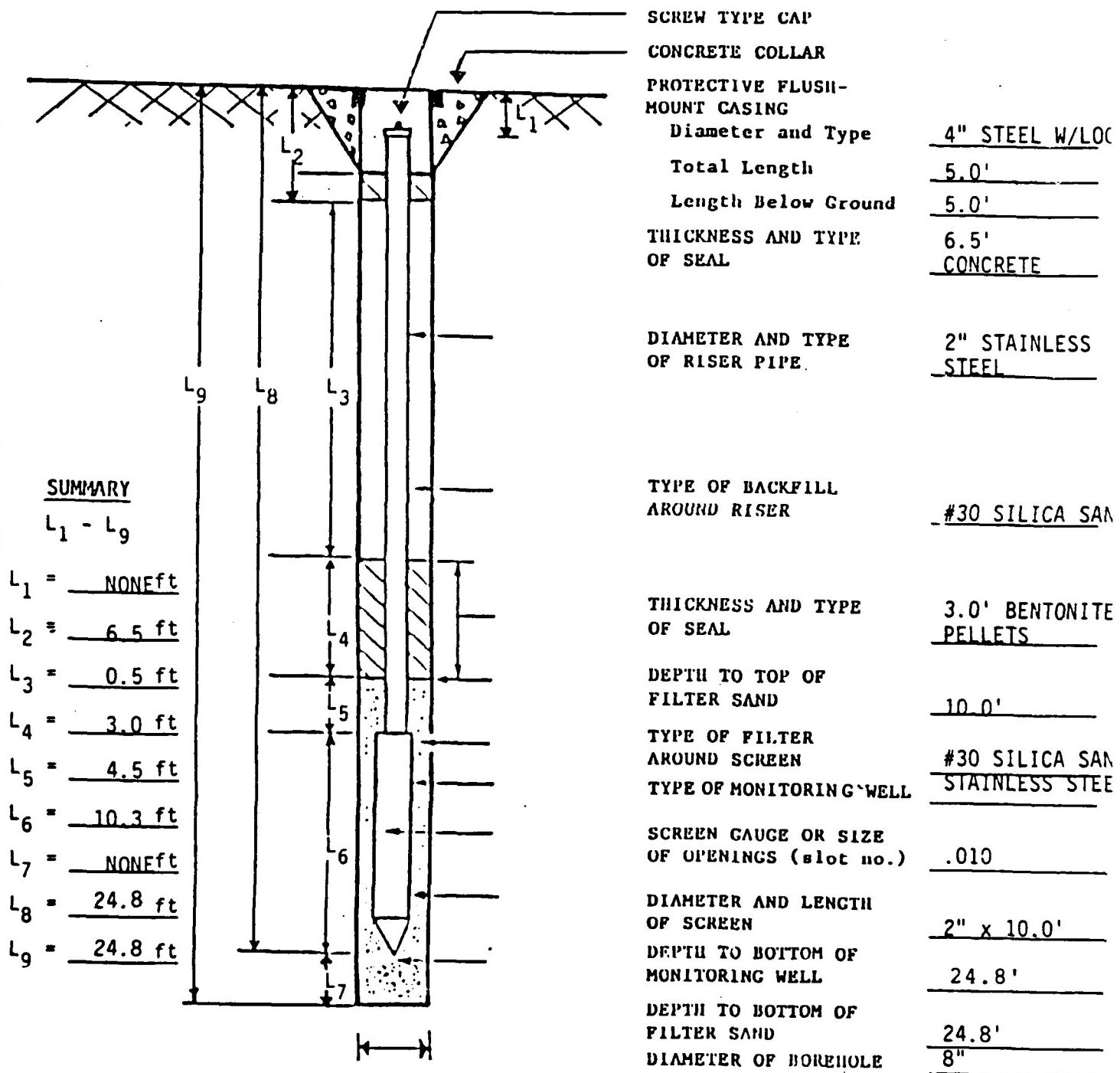
INSTALLATION OF FLUSH MOUNT MONITORING WELL

JOB NO. 8100-89-0181

GROUND SURFACE ELEVATION 691.54

MONITORING WELL NO. OW 112B

TOP OF RISER PIPR ELEVATION 691.36
(With cap removed)



Installation Completed
Date 11-17-88 Time 15:55

SP-1988A

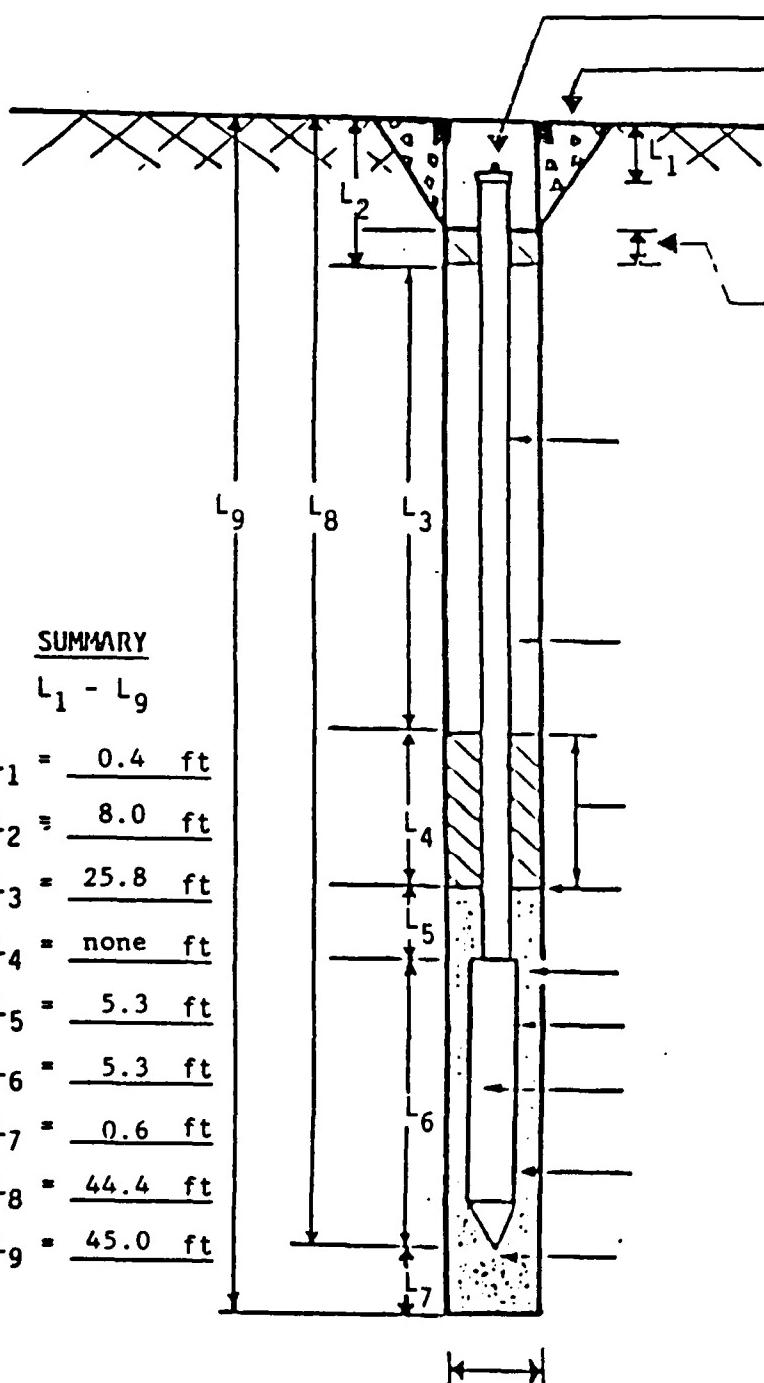
INSTALLATION OF FLUSH MOUNT PIEZOMETER

JOB NUMBER 8100-89-0181

GROUND SURFACE ELEVATION 691.76

PIEZOMETER NO. 112A

**TOP OF RISER PIPE ELEVATION 691.22
(With Cap Removed)**



SCREW TYPE CAP

CONCRETE COLLAR *

PROTECTIVE FLUSH-MOUNT CASING

Diameter and Type 4" STEEL W/LOCK

Total Length 5.0'

Length Below Ground 5.0'

**THICKNESS AND TYPE OF SEAL 4.0' CONCRETE
3.0' GRANULAR BENTONITE**

DIAMETER AND TYPE OF RISER PIPE 2" STAINLESS STEEL

SUMMARY

L₁ - L₉

L₁ = 0.4 ft

L₂ = 8.0 ft

L₃ = 25.8 ft

L₄ = none ft

L₅ = 5.3 ft

L₆ = 5.3 ft

L₇ = 0.6 ft

L₈ = 44.4 ft

L₉ = 45.0 ft

TYPE OF BACKFILL AROUND RISER

BENTONITE POWDER SAND SLURRY

THICKNESS AND TYPE OF SEAL

NONE

DEPTH TO TOP OF FILTER SAND

33.8'

TYPE OF FILTER AROUND SCREEN

#30 SILICA SAND

TYPE OF PIEZOMETER

STAINLESS STEEL

SCREEN GAUGE OR SIZE OF OPENINGS (slot no.)

0.010

DIAMETER AND LENGTH OF SCREEN

2" x 5.0'

DEPTH TO BOTTOM OF MONITORING WELL

45.0

DEPTH TO BOTTOM OF FILTER SAND

45.0'

DIAMETER OF BOREHOLE

8"

* WELL INSTALLED IN MANHOLE

**Installation Completed
Date 11-23-88 Time 12:00**

SF-1988A

INSTALLATION OF MONITORING WELL

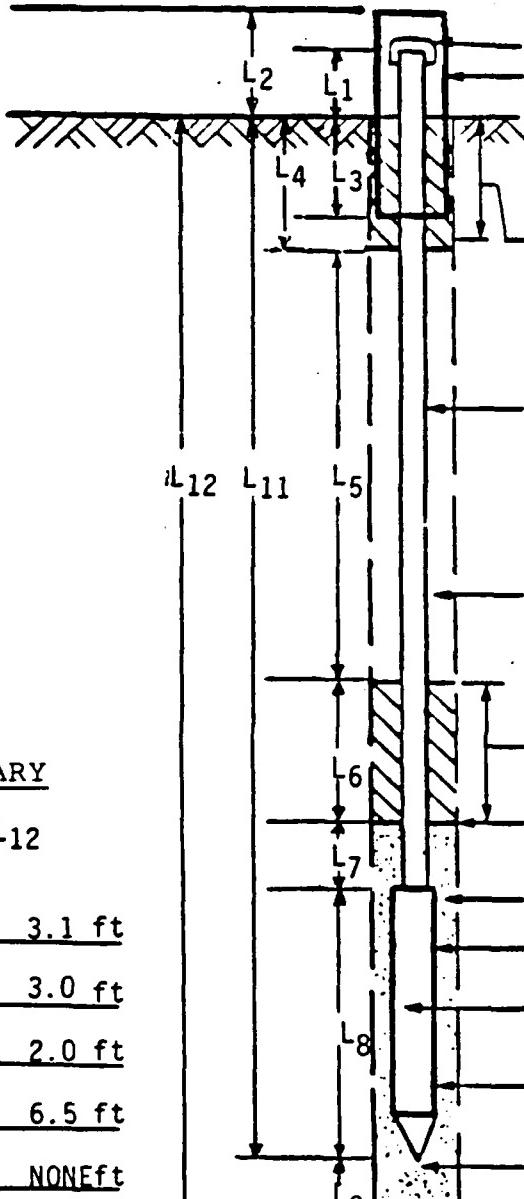
JOB NO. 8100-89-0181

MONITORING WELL NO. OW 113B

GROUND SURFACE ELEVATION 679.94

TOP OF RISER PIPE ELEVATION
(with cap removed)

682.94

SUMMARYL₁ - L₁₂L₁ = 3.1 ftL₂ = 3.0 ftL₃ = 2.0 ftL₄ = 6.5 ftL₅ = NONE ftL₆ = NONE ftL₇ = 1.2 ftL₈ = 10.3 ftL₉ = 2.0 ftL₁₀ = NONE ftL₁₁ = 18' ftL₁₂ = 20' ft

VENTED CAP

PROTECTIVE CASING

Diameter and Type

Total Length

Length Above Ground

THICKNESS AND TYPE OF SEAL

4" STEEL W/LOCK

5.0'

3.0'

4.5' CONCRETE

2.0' BENTONITE
PELLETS

DIAMETER AND TYPE OF RISER PIPE

2" STAINLESS STEEL

NONE

NONE

6.5'

#3 SILICA SAND

STAINLESS STEEL

.010

2" x 10.0

18'

20'

NONE

8'

INSTALLATION COMPLETED:
Date 11-5-88 Time 10:00

INSTALLATION OF PIEZOMETER

JOB NO. 8100-89-0181

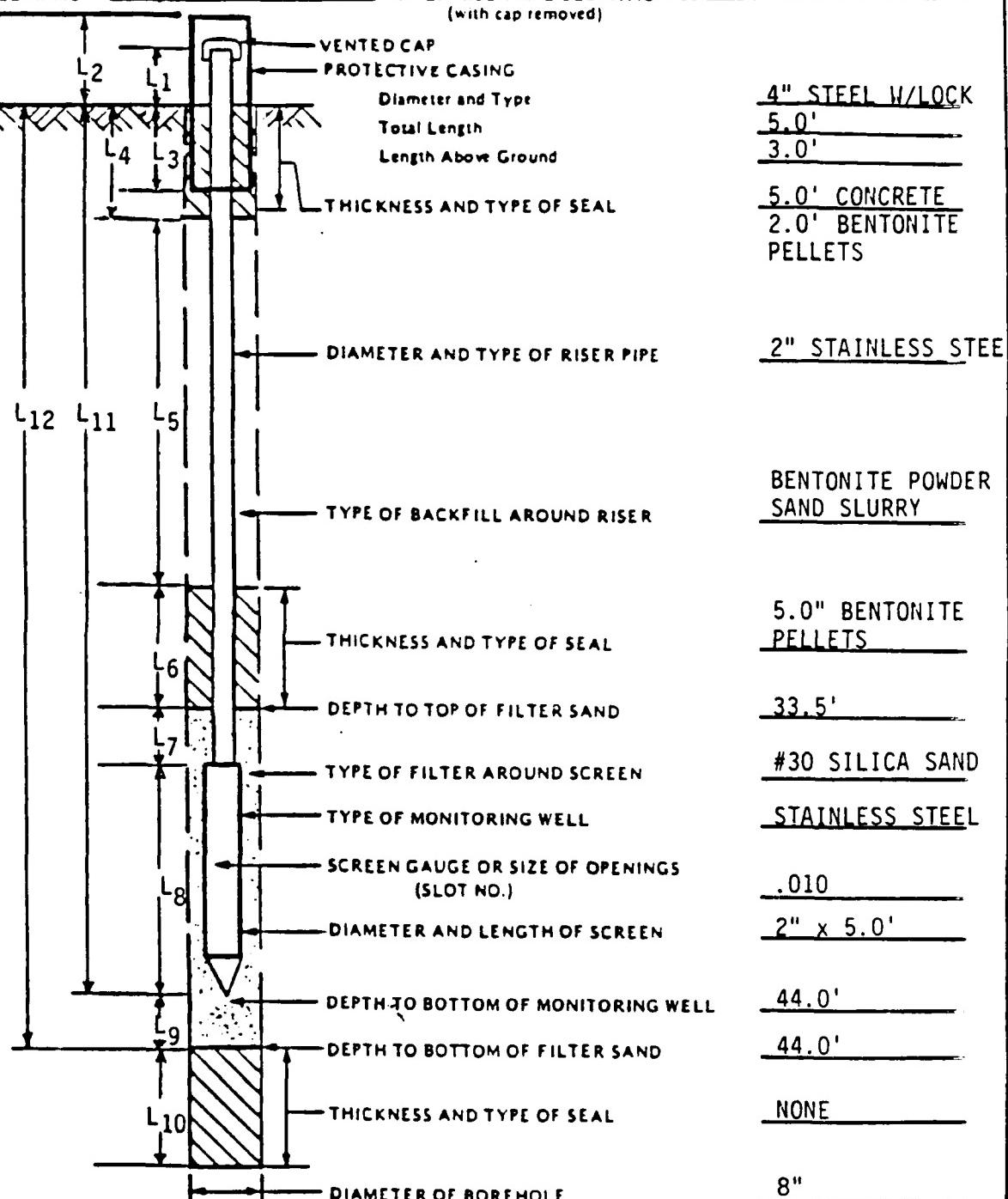
PIEZOMETER NO. 113A

GROUND SURFACE ELEVATION

679.98

**TOP OF RISER PIPE ELEVATION
(with cap removed)**

682.98



SUMMARY

$L_1 - L_{12}$

$L_1 =$ 3.0 ft

$L_2 =$ 3.0 ft

$L_3 =$ 2.0 ft

$L_4 =$ 7.0 ft

$L_5 =$ 21.5 ft

$L_6 =$ 5.0 ft

$L_7 =$ 5.2 ft

$L_8 =$ 5.3 ft

$L_9 =$ NONEft

$L_{10} =$ NONEft

$L_{11} =$ 44' ft

$L_{12} =$ 44' ft

4" STEEL W/LOCK

5.0'

3.0'

5.0' CONCRETE

2.0' BENTONITE

PELLETS

2" STAINLESS STEE

BENTONITE POWDER
SAND SLURRY

5.0" BENTONITE
PELLETS

33.5'

#30 SILICA SAND

STAINLESS STEEL

.010

2" x 5.0'

44.0'

44.0'

NONE

8"

INSTALLATION COMPLETED:

Date 11-16-88 Time 11:51

APPENDIX E
WELL DEVELOPMENT FORMS

SAMPLING INFORMATION

Sampling Point Piezometer 113A Project U.S. Army Reserve Center
Location Milwaukee, Wisconsin W.O.# 8100-89-0181

Sample ID # N/A Date Sampled ---/--/-- Time N/A AM/PM
Describe Sampling Point N/A

Well Depth 44 ft. below MP Casing Diameter 2 inches
 Depth to Water (below MP) 8.2 ft. Date 11/24/88 Time 09:30 AM/PM
 Discharge Rate = --- gpm x 0.00223 = --- cfs.
 At least --- bore volumes have been evacuated before sampling.

Tap Submersible Pump Boiler Other

Sampling Method: Tap Submersible Pump
Pump intake or boiler set at: 500 ft. below M.R.

Tubing (type: ---), (new or previously used) was used to collect all samples (yes, no) and all field measurements (yes, no). Tubing used only for ---

Sample Appearance: Turbid **Odor:** No

Note any Sampling Problems: Well bailed dry

Note any sampling problems: _____

Samples Collected:

EVACUATION/STABILIZATION TEST DATA

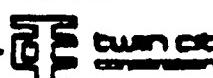
Pumping start time 09:30
Pumping stop time 12:50

WL 8.20
WL Dry

Comments: _____

Form completed by: G Wellner

Reviewed by: R Levra



SAMPLING INFORMATION

Sampling Point OW 112B **Project** U.S. Army Reserve Center
Location Milwaukee, Wisconsin **W.O.#** 8100-89-0181

Sample ID # N/A Date Sampled -- / -- / -- Time N/A AM/PM
Describe Sampling Point N/A

Well Depth 24.8 ft. below MP Casing Diameter 2 inches
Depth to Water (below MP) 17.90 ft. Date 11 / 24 / 89 Time 13:01 XXX/PM
Discharge Rate = --- gpm x 0.00223 = --- cfs.

At least **bore volumes have been evacuated before sampling.**

Sampling Method: Tap Submersible Pump Baiter _____ Other _____

Pump intake or bailer set at --- ft. below MP.

Tubing (type: ---), (new or previously used) was used to collect all samples (yes, no) and all field measurements (yes, no). Tubing used only for ---

Sample Appearance: Clear **Odor:** None

Note any Sampling Problems: None

Note any Cleaning performed in field: None

Samples Collected: 100

EVACUATION/STABILIZATION TEST DATA

Pumping start time 13:01

WL 17.9

Pumping start time _____
Pumping stop time 14:30

WL 18.0

Comments:

Comments: _____

Digitized by srujanika@gmail.com

Digitized by srujanika@gmail.com

Form completed by: G. Wellner Reviewed by: R. L. Evans

卷之三



SAMPLING INFORMATION

Sampling Point Piezometer 112A Project U.S. Army Reserve Center
Location Milwaukee, Wisconsin W.O. # 8100-89-0181

Sample ID # N/A Date Sampled 1-1-1 Time N/A AM/PM
Describe Sampling Point N/A

Well Depth 44.4 ft. below MP Casing Diameter 2 inches
 Depth to Water (below MP) 17.7 ft. Date 11/24/88 Time 13:07 XXX/PM
 Discharge Rate = --- gpm x 0.00223 = --- cfs.
 At least --- bore volumes have been evacuated before sampling.

Sampling Method : Tap Submersible Pump Bailer _____ Other _____
Pump intake or bailer set at _____ ft. below MP.
Tubing (type: _____), (new or previously used) was used to collect all samples (yes, no)
and all field measurements (yes, no). Tubing used only for _____

Sample Appearance: Clear **Odor:** None
Note any Sampling Problems: None
Note any Cleaning performed in field: None
Samples Collected: ---

EVACUATION/STABILIZATION TEST DATA

Pumping start time 13:07 WL 17.70
Pumping stop time 15:30 WL 17.70

Comments: _____

Form completed by: G Wellner **Reviewed by:** R Leyva



MAR-03-1989 09:00 FROM TCT WAUSAU,WI

TO

DONOHUE-SHEBOY

P. 03

SAMPLING INFORMATION

Sampling Point UW-113B Project U.S. Army Reserve Center
Location Milwaukee, Wisconsin W.O.# 8100-89-0181

Sample ID # N/A Date Sampled ---/--/-- Time N/A AM/PM
Describe Sampling Point N/A

Well Depth 18.0 ft. below MP Casing Diameter 2 inches
 Depth to Water (below MP) 9.15 ft. Date 11 / 24 / 88 Time 09:30 AM/XX
 Discharge Rate = --- gpm x 0.00223 = --- cfs.
 At least --- bore volumes have been pumped off.

Sampling Method : Tap Submersible Pump Baiter Other

Pump Intake or tailer set at --- ft below MR

Tubing (type: ---), (new or previously used) was used to collect all samples (yes, no) and all field measurements (yes, no). Tubing used only for ---.

Sample Appearance: Clear Odor: None

Note any Sampling Problems: None

Note any Cleaning performed in field: None

Samples Collected: N/A

EVACUATION/STABILIZATION TEST DATA

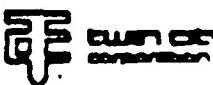
Pumping start time 09:30
Pumping stop time 12:50

WL 9.15

Comments: _____

Form completed by: G Wellner

Reviewed by: R Levra



APPENDIX F
GROUNDWATER SAMPLING RESULTS

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number OW-101B

Parameter	Groundwater Standards, mg/l			Analytical Results, mg/l				
	PAL	ES		1/87	3/87	5/87	7/87	9/87
Indicators:								
COD	25	-		0.13	24	10	25	25
BOD	25	-		<6	<6	<6	6	<6
Boron	2	-		0.23	0.48	0.34	0.42	0.6
Cond @ 25°	200	-		1410	1397	1291	1381	1231
pH	+/-1	-		6.48	6.97	6.73	6.87	7
Hardness	100	-		660	710	670	740	760
Alkalinity	100	-		520	540	560	540	520
NH3-N	2	-		0.65	0.1	1	0.7	0.6
Public Health and Welfare:								
Chloride	125	250		80	65	54	57	60
Sulfates	125	250		240	260	240	280	280
Chromium	0.005	0.05		<0.005	<0.005	<0.005	<0.005	<0.005
Mercury	0.0002	0.002		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lead	0.005	0.05		<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	0.001	0.01		<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	0.005	0.05		<0.005	<0.005	<0.005	<0.005	<0.005
Dis Iron	0.15	0.3		<0.1	0.16	0.11	<0.1	0.86
NO2+NO3-N	2	10		0.06	<0.05	0.1	<0.05	0.12
Barium	0.2	1		<1	<1	<1	<1	<1

Notes:

PAL - Denotes Preventive Action Limit (Increase above background)

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number OW-101B

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l			
	PAL	ES	2/87	7/87	12/88	1/89
Methylene chloride	15	150	NA	NA	X	2
1,1 - Dichloroethylene	0.024	0.24	X	NA	X	X
1,1 - Dichloroethane	85	850	0.5	NA	1	3
Chloroform	-	-	X	NA	X	X
Carbon tetrachloride	-	-	X	NA	X	X
1,2 - Dichloropropane	-	-	X	NA	X	X
Trichloroethylene (TCE)	0.18	1.8	X	NA	X	X
1,1,2 - Trichloroethane	0.06	0.6	X	NA	X	X
Dibromochloromethane	-	-	X	NA	X	X
Tetrachloroethylene	0.1	1	X	NA	X	X
Chlorobenzene	-	-	X	NA	X	X
Trans-1,2-Dichloroethylene	20	100	NA	NA	X	X
1,2 - Dichloroethane	0.05	0.5	X	NA	X	X
1,1,1 - Trichloroethane	40	200	X	NA	X	X
Bromodichloromethane	-	-	X	NA	X	X
Benzene	0.067	0.67	X	NA	X	X
Bromoform	-	-	X	NA	X	X
1,1,2,2-Tetrachloroethane	-	-	X	NA	X	X
Toluene	68.6	343	X	NA	X	X
Ethylbenzene	272	1360	X	NA	X	X
Vinyl chloride	0.0015	0.015	12.5	18.6	X	X
Total xylene	124	620	NA	NA	X	X
1,2-Dichlorobenzene	125	1250	X	NA	X	X
1,3-Dichlorobenzene	125	1250	X	NA	X	X
1,4-Dichlorobenzene	150	750	X	NA	X	X
2-Chloroethylvinyl Ether	-	-	X	NA	X	X
Cis-1,2-Dichloroethylene	10	100	NA	NA	49	86
trans-1,3-dichloropropene	-	-	X	NA	X	X
cis-1,3-dichloropropene	-	-	X	NA	X	X
Total 1,2-Dichloroethylene	-	-	23.8	18.9	NA	NA
Bromomethane	-	-	X	NA	NA	NA
Chloroethane	-	-	X	NA	NA	NA
Chloromethane	-	-	X	NA	NA	NA
Dichloromethane	-	-	X	NA	NA	NA
Trichlorofluoromethane	698	3490	X	NA	NA	NA
Dichlorodifluoromethane	-	-	X	NA	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number P-101A

Parameter	Groundwater Standards, mg/l		Analytical Results, mg/l				
	PAL	ES	1/87	3/87	5/87	7/87	9/87
Indicators:							
COD	25	-	29	23	26	20	35
BOD	25	-	<6	<6	<6	<6	<6
Boron	2	-	0.16	0.18	0.13	0.22	0.29
Cond @ 25°	200	-	1362	1334	1064	1258	1165
pH	+/-1	-	6.67	6.9	7.3	6.64	6.87
Hardness	100	-	620	680	540	670	1300
Alkalinity	100	-	410	420	320	410	400
NH3-N	2	-	0.42	0.1	0.9	0.4	0.3
Public Health and Welfare:							
Chloride	125	250	130	84	86	80	80
Sulfates	125	250	260	260	250	260	220
Chromium	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury	0.0002	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lead	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	0.001	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Dis Iron	0.15	0.3	3.4	3.4	0.22	0.67	3.4
NO2+NO3-N	2	10	<0.05	<0.05	<0.05	<0.05	0.08
Barium	0.2	1	<1	<1	<1	<1	<1

Notes:

PAL - Denotes Preventive Action Limit (Increase above background)

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number P-101A

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l			
	PAL	ES	2/87	7/87	12/88	1/89
Methylene chloride	15	150	NA	NA	X	6
1,1 - Dichloroethylene	0.024	0.24	X	NA	X	X
1,1 - Dichloroethane	85	850	X	NA	X	X
Chloroform	-	-	X	NA	X	X
Carbon tetrachloride	-	-	X	NA	X	X
1,2 - Dichloropropane	-	-	X	NA	X	X
Trichloroethylene (TCE)	0.18	1.8	X	NA	X	X
1,1,2 - Trichloroethane	0.06	0.6	X	NA	X	X
Dibromochloromethane	-	-	X	NA	X	X
Tetrachloroethylene	0.1	1	X	NA	X	X
Chlorobenzene	-	-	X	NA	X	X
Trans-1,2-Dichloroethylene	20	100	NA	NA	X	X
1,2 - Dichloroethane	0.05	0.5	X	NA	X	2
1,1,1 - Trichloroethane	40	200	X	NA	X	X
Bromodichloromethane	-	-	X	NA	X	X
Benzene	0.067	0.67	X	NA	X	X
Bromoform	-	-	X	NA	X	X
1,1,2,2-Tetrachloroethane	-	-	X	NA	X	X
Toluene	68.6	343	X	NA	X	X
Ethylbenzene	272	1360	X	NA	X	X
Vinyl chloride	0.0015	0.015	336	304	X	X
Total xylene	124	620	NA	NA	X	X
1,2-Dichlorobenzene	125	1250	X	NA	X	X
1,3-Dichlorobenzene	125	1250	X	NA	X	X
1,4-Dichlorobenzene	150	750	X	NA	X	3
2-Chloroethylvinyl Ether	-	-	X	NA	X	X
Cis-1,2-Dichloroethylene	10	100	NA	NA	X	X
trans-1,3-dichloropropene	-	-	X	NA	X	X
cis-1,3-dichloropropene	-	-	X	NA	X	X
Total 1,2-Dichloroethylene	-	-	X	NA	NA	NA
Bromomethane	-	-	X	NA	NA	NA
Chloroethane	-	-	X	NA	NA	NA
Chloromethane	-	-	X	NA	NA	NA
Dichloromethane	-	-	X	NA	NA	NA
Trichlorofluoromethane	698	3490	X	NA	NA	NA
Dichlorodifluoromethane	-	-	X	NA	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

P

**US Army Reserve 84th Division
Groundwater Sampling and Analysis**

Well Number DW-102B

Parameter	Groundwater Standards, mg/l		Analytical Results, mg/l				
	PAL	ES	1/87	3/87	5/87	7/87	9/87
Indicators:							
COD	25	-	0.28	34	14	53	20
BOD	25	-	7	<6	<6	<6	<6
Boron	2	-	0.16	0.44	0.3	0.31	0.45
Cond @ 25°	200	-	1305	1256	1045	1180	1045
pH	+/-1	-	6.79	6.75	6.99	6.77	6.93
Hardness	100	-	540	370	690	630	900
Alkalinity	100	-	470	500	510	480	440
NH3-N	2	-	1	0.1	0.9	1.4	1.2
Public Health and Welfare:							
Chloride	125	250	54	24	31	63	45
Sulfates	125	250	210	240	270	180	180
Chromium	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury	0.0002	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lead	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	0.001	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Dis Iron	0.15	0.3	<0.1	<0.1	0.11	<0.1	2.3
NO2+NO3-N	2	10	<0.05	0.08	<0.05	<0.05	0.12
Barium	0.2	1	<1	<1	<1	<1	<1

Notes:

PAL - Denotes Preventive Action Limit (Increase above background)

ES - Denotes Enforcement Standard

US Army Reserve 64th Division
Groundwater Sampling and Analysis

Well Number QW-102B

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l			
	PAL	ES	2/87	7/88	12/88	1/89
Methylene chloride	15	150	NA	NA	X	3
1,1 - Dichloroethylene	0.024	0.24	X	NA	X	X
1,1 - Dichloroethane	85	850	1.2	NA	1	3
Chloroform	-	-	X	NA	X	X
Carbon tetrachloride	-	-	X	NA	X	X
1,2 - Dichloropropane	-	-	X	NA	X	X
Trichloroethylene (TCE)	0.18	1.8	1	NA	0.6	X
1,1,2 - Trichloroethane	0.06	0.6	X	NA	X	X
Dibromochloromethane	-	-	X	NA	X	X
Tetrachloroethylene	0.1	1	X	NA	X	X
Chlorobenzene	-	-	X	NA	X	X
Trans-1,2-Dichloroethylene	20	100	NA	NA	X	X
1,2 - Dichloroethane	0.05	0.5	X	NA	X	X
1,1,1 - Trichloroethane	40	200	X	NA	X	X
Bromodichloromethane	-	-	X	NA	X	X
Benzene	0.067	0.67	X	NA	1	X
Bromoform	-	-	X	NA	X	X
1,1,2,2-Tetrachloroethane	-	-	X	NA	X	X
Toluene	68.0	343	X	NA	X	X
Ethylbenzene	272	1360	X	NA	X	X
Vinyl chloride	0.0015	0.015	23.1	42.5	X	X
Total xylene	124	620	NA	NA	2	X
1,2-Dichlorobenzene	125	1250	X	NA	X	X
1,3-Dichlorobenzene	125	1250	X	NA	X	X
1,4-Dichlorobenzene	150	750	X	NA	X	X
2-Chloroethylvinyl Ether	-	-	X	NA	X	X
Cis-1,2-Dichloroethylene	10	100	NA	NA	11	16
trans-1,3-dichloropropene	-	-	X	NA	X	X
cis-1,3-dichloropropene	-	-	X	NA	X	X
Total 1,2-Dichloroethylene	-	-	13.9	14.6	NA	NA
Bromomethane	-	-	X	NA	NA	NA
Chloroethane	-	-	X	NA	NA	NA
Chloromethane	-	-	X	NA	NA	NA
Dichloromethane	-	-	0.3	NA	NA	NA
Trichlorofluoromethane	698	3490	X	NA	NA	NA
Dichlorodifluoromethane	-	-	X	NA	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

**US Army Reserve 84th Division
Groundwater Sampling and Analysis**

Well Number P-102A

Parameter Indicators:	Groundwater Standards, mg/l		Analytical Results, mg/l				
	PAL	ES	1/87	3/87	5/87	7/87	9/87
COD	25	-	49	<5	14	20	25
BOD	25	-	<6	7	<6	7	<6
Boron	2	-	0.23	0.33	0.25	0.34	0.42
Cond @ 25°	200	-	1156	1175	814	1105	993
pH	+/-1	-	7	7.11	7.22	7.06	7.1
Hardness	100	-	460	600	550	590	600
Alkalinity	100	-	340	430	440	460	420
NH3-N	2	-	0.57	0.1	0.7	1.1	1.2
Public Health and Welfare:							
Chloride	125	250	75	38	42	47	200
Sulfates	125	250	230	220	200	160	200
Chromium	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury	0.0002	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lead	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	0.001	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Dis Iron	0.15	0.3	<0.1	<0.1	0.22	0.51	1.1
NO2+NO3-N	2	10	0.19	0.25	0.11	<0.05	0.17
Barium	0.2	1	<1	<1	<1	<1	<1

Notes:

PAL - Denotes Preventive Action Limit (Increase above background)

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number P-102A

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l			
	PAL	ES	2/87	7/87	12/88	1/89
Methylene chloride	15	150	NA	NA	X	10
1,1 - Dichloroethylene	0.024	0.24	X	NA	X	X
1,1 - Dichloroethane	85	850	0.7	NA	2	7
Chloroform	-	-	X	NA	X	X
Carbon tetrachloride	-	-	X	NA	X	X
1,2 - Dichloropropane	-	-	X	NA	X	X
Trichloroethylene (TCE)	0.18	1.8	X	NA	X	8
1,1,2 - Trichloroethane	0.06	0.6	X	NA	X	5
Dibromochloromethane	-	-	X	NA	3	2
Tetrachloroethylene	0.1	1	X	NA	X	X
Chlorobenzene	-	-	X	NA	X	3
Trans-1,2-Dichloroethylene	20	100	NA	NA	X	X
1,2 - Dichloroethane	0.05	0.5	X	NA	X	5
1,1,1 - Trichloroethane	40	200	X	NA	X	X
Bromodichloromethane	-	-	X	NA	X	5
Benzene	0.067	0.67	X	NA	X	X
Bromoform	-	-	X	NA	5	X
1,1,2,2-Tetrachloroethane	-	-	X	NA	X	X
Toluene	68.6	343	X	NA	X	X
Ethylbenzene	272	1360	X	NA	X	X
Vinyl chloride	0.0015	0.015	3	29.4	X	X
Total xylene	124	620	NA	NA	5	5
1,2-Dichlorobenzene	125	1250	X	NA	10	18
1,3-Dichlorobenzene	125	1250	X	NA	15	14
1,4-Dichlorobenzene	150	750	X	NA	8	14
2-Chloroethylvinyl Ether	-	-	X	NA	X	X
Cis-1,2-Dichloroethylene	10	100	NA	NA	8	30
trans-1,3-dichloropropene	-	-	X	NA	1	X
cis-1,3-dichloropropene	-	-	X	NA	3	X
Total 1,2-Dichloroethylene	-	-	4	8.6	NA	NA
Bromomethane	-	-	X	NA	NA	NA
Chloroethane	-	-	X	NA	NA	NA
Chloroethane	-	-	X	NA	NA	NA
Dichloromethane	-	-	X	NA	NA	NA
Trichlorofluoromethane	698	3490	X	NA	NA	NA
Dichlorodifluoromethane	-	-	X	NA	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number DW-105B

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l	
	PAL	ES	12/88	1/89
Methylene chloride	15	150	X	7
1,1 - Dichloroethylene	0.024	0.24	X	X
1,1 - Dichloroethane	85	850	X	4.8
Chloroform	-	-	X	X
Carbon tetrachloride	-	-	X	3
1,2 - Dichloropropane	-	-	X	X
Trichloroethylene (TCE)	0.18	1.8	X	3.1
1,1,2 - Trichloroethane	0.06	0.6	X	3
Dibromochloromethane	-	-	X	X
Tetrachloroethylene	0.1	1	X	2
Chlorobenzene	-	-	X	2
Trans-1,2-Dichloroethylene	20	100	X	2.4
1,2 - Dichloroethane	0.05	0.5	X	6
1,1,1 - Trichloroethane	40	200	X	6
Bromodichloromethane	-	-	X	2
Benzene	0.067	0.67	X	X
Bromoform	-	-	X	X
1,1,2,2-Tetrachloroethane	-	-	X	X
Toluene	68.6	343	X	X
Ethylbenzene	272	1360	X	X
Vinyl chloride	0.0015	0.015	X	X
Total xylene	124	620	X	3
1,2-Dichlorobenzene	125	1250	X	6
1,3-Dichlorobenzene	125	1250	X	5
1,4-Dichlorobenzene	150	750	X	3
2-Chloroethylvinyl Ether	-	-	X	X
Cis-1,2-Dichloroethylene	10	100	X	6.6
trans-1,3-dichloropropene	-	-	X	X
cis-1,3-dichloropropene	-	-	X	X
Total 1,2-Dichloroethylene	-	-	NA	NA
Bromomethane	-	-	NA	NA
Chloroethane	-	-	NA	NA
Chloromethane	-	-	NA	NA
Dichloroethane	-	-	NA	NA
Trichlorofluoromethane	698	3490	NA	NA
Dichlorodifluoromethane	-	-	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number P-105A

Parameter	Groundwater Standards, mg/l		Analytical Results, mg/l				
	PAL	ES	1/87	3/87	5/87	7/87	9/87
Indicators:							
COD	25	-	18	16	18	<5	10
BOD	25	-	<6	<6	<6	<6	<6
Boron	2	-	0.36	0.25	0.15	0.23	0.27
Cond @ 25°	200	-	1536	1463	860	1100	1203
pH	+/-1	-	6.75	7.1	7.09	6.95	6.95
Hardness	100	-	730	760	720	720	820
Alkalinity	100	-	420	430	430	410	420
NH3-N	2	-	0.27	0.3	0.2	0.5	0.2
Public Health and Welfare:							
Chloride	125	250	150	100	100	100	75
Sulfates	125	250	300	300	310	290	320
Chromium	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury	0.0002	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lead	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	0.001	0.01	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Dis Iron	0.15	0.3	2.9	2.8	1.7	<0.1	2.1
NO2+NO3-N	2	10	<0.05	<0.05	<0.05	<0.05	0.06
Barium	0.2	1	<1	<1	<1	<1	<1

Notes:

PAL - Denotes Preventive Action Limit (Increase above background)

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number P-105A

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l			
	PAL	ES	2/87	7/87	12/88	1/89
Methylene chloride	15	150	NA	NA	X	2
1,1 - Dichloroethylene	0.024	0.24	X	NA	X	X
1,1 - Dichloroethane	85	850	X	NA	X	X
Chloroform	-	-	X	NA	X	X
Carbon tetrachloride	-	-	X	NA	X	X
1,2 - Dichloropropane	-	-	X	NA	X	X
Trichloroethylene (TCE)	0.18	1.8	X	NA	X	1.2
1,1,2 - Trichloroethane	0.06	0.6	X	NA	X	X
Dibromochloromethane	-	-	X	NA	X	X
Tetrachloroethylene	0.1	1	X	NA	X	X
Chlorobenzene	-	-	X	NA	X	X
Trans-1,2-Dichloroethylene	20	100	NA	NA	X	0.5
1,2 - Dichloroethane	0.05	0.5	X	NA	X	4
1,1,1 - Trichloroethane	40	200	X	NA	X	X
Bromodichloromethane	-	-	X	NA	X	X
Benzene	0.067	0.67	X	NA	X	X
Bromoform	-	-	X	NA	X	X
1,1,2,2-Tetrachloroethane	-	-	X	NA	X	X
Toluene	68.6	343	X	NA	X	X
Ethylbenzene	272	1360	X	NA	X	X
Vinyl chloride	0.0015	0.015	39.9	19.1	X	X
Total xylene	124	620	NA	NA	X	X
1,2-Dichlorobenzene	125	1250	X	NA	X	6
1,3-Dichlorobenzene	125	1250	X	NA	X	X
1,4-Dichlorobenzene	150	750	X	NA	X	4
2-Chloroethylvinyl Ether	-	-	X	NA	X	X
Cis-1,2-Dichloroethylene	10	100	NA	NA	2	20
trans-1,3-dichloropropene	-	-	X	NA	X	X
cis-1,3-dichloropropene	-	-	X	NA	X	NA
Total 1,2-Dichloroethylene	-	-	X	NA	NA	NA
Bromomethane	-	-	X	NA	NA	NA
Chloroethane	-	-	X	NA	NA	NA
Chloromethane	-	-	X	NA	NA	NA
Dichloromethane	-	-	X	NA	NA	NA
Trichlorofluoromethane	698	3490	X	NA	NA	NA
Dichlorodifluoromethane	-	-	X	NA	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number DW-106B

Parameter	Groundwater Standards, mg/l		Analytical Results, mg/l				
	PAL	ES	1/87	3/87	5/87	7/87	9/87
Indicators:							
COD	25	-	0.21	<5	6	<5	15
BOD	25	-	<6	<6	<6	<6	<6
Boron	2	-	0.49		0.08	0.05	0.19
Cond @ 25°	200	-	982	932	1417	805	856
pH	+/-1	-	6.8	7.06	7.5	7.05	6.87
Hardness	100	-	480	560	490	550	570
Alkalinity	100	-	380	390	380	400	390
NH3-N	2	-	0.15	<0.1	<0.1	<0.1	0.1
Public Health and Welfare:							
Chloride	125	250	150	20	21	18	15
Sulfates	125	250	300	180	160	130	170
Chromium	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury	0.0002	0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Lead	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	0.001	0.01	<0.001	<0.001	<0.001	<0.001	0.0029
Arsenic	0.005	0.05	<0.005	<0.005	<0.005	<0.005	<0.005
Dis Iron	0.15	0.3	<0.1	<0.1	0.2	<0.1	<0.1
NO2+NO3-N	2	10	<0.05	<0.05	<0.05	<0.05	0.08
Barium	0.2	1	<1	<1	<1	<1	<1

Notes:

PAL - Denotes Preventive Action Limit (Increase above background)

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number DW-106B

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l		
	PAL	ES	2/87	12/88	1/89
Methylene chloride	15	150	NA	X	5
1,1 - Dichloroethylene	0.024	0.24	X	X	X
1,1 - Dichloroethane	85	850	X	X	0.9
Chloroform	-	-	X	X	3
Carbon tetrachloride	-	-	X	X	X
1,2 - Dichloropropane	-	-	X	X	X
Trichloroethylene (TCE)	0.18	1.8	X	X	0.7
1,1,2 - Trichloroethane	0.06	0.6	X	X	3
Dibromochloromethane	-	-	X	X	X
Tetrachloroethylene	0.1	1	X	X	X
Chlorobenzene	-	-	X	X	X
Trans-1,2-Dichloroethylene	20	100	NA	X	X
1,2 - Dichloroethane	0.05	0.5	X	X	2
1,1,1 - Trichloroethane	40	200	X	X	X
Bromodichloromethane	-	-	X	X	2
Benzene	0.067	0.67	X	X	X
Bromoform	-	-	X	X	X
1,1,2,2-Tetrachloroethane	-	-	X	X	X
Toluene	68.6	343	X	X	X
Ethylbenzene	272	1360	X	X	X
Vinyl chloride	0.0015	0.015	X	X	X
Total xylene	124	620	NA	X	X
1,2-Dichlorobenzene	125	1250	X	X	10
1,3-Dichlorobenzene	125	1250	X	X	8
1,4-Dichlorobenzene	150	750	X	X	8
2-Chloroethylvinyl Ether	-	-	X	X	X
Cis-1,2-Dichloroethylene	10	100	NA	X	4
trans-1,3-dichloropropene	-	-	X	X	X
cis-1,3-dichloropropene	-	-	X	X	X
Total 1,2-Dichloroethylene	-	-	X	NA	NA
Bromomethane	-	-	X	NA	NA
Chloroethane	-	-	X	NA	NA
Chloromethane	-	-	X	NA	NA
Dichloromethane	-	-	X	NA	NA
Trichlorofluoromethane	698	3490	X	NA	NA
Dichlorodifluoromethane	-	-	X	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number P-106A

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l	
	PAL	ES	12/88	1/89
Methylene chloride	15	150	X	9
1,1 - Dichloroethylene	0.024	0.24	X	X
1,1 - Dichloroethane	85	850	X	2
Chloroform	-	-	X	5
Carbon tetrachloride	-	-	X	X
1,2 - Dichloropropane	-	-	X	X
Trichloroethylene (TCE)	0.18	1.8	X	X
1,1,2 - Trichloroethane	0.06	0.6	X	6
Dibromochloromethane	-	-	X	3
Tetrachloroethylene	0.1	1	X	X
Chlorobenzene	-	-	X	2
Trans-1,2-Dichloroethylene	20	100	X	X
1,2 - Dichloroethane	0.05	0.5	X	5
1,1,1 - Trichloroethane	40	200	X	X
Bromodichloromethane	-	-	X	4
Benzene	0.067	0.67	X	X
Bromoform	-	-	X	2
1,1,2,2-Tetrachloroethane	-	-	X	X
Toluene	68.6	343	X	X
Ethylbenzene	272	1360	X	X
Vinyl chloride	0.0015	0.015	X	X
Total xylene	124	620	X	4
1,2-Dichlorobenzene	125	1250	X	17
1,3-Dichlorobenzene	125	1250	X	12
1,4-Dichlorobenzene	150	750	X	12
2-Chloroethylvinyl Ether	-	-	X	X
Cis-1,2-Dichloroethylene	10	100	3	10
trans-1,3-dichloropropene	-	-	X	X
cis-1,3-dichloropropene	-	-	X	X
Total 1,2-Dichloroethylene	-	-	NA	NA
Bromoethane	-	-	NA	NA
Chloroethane	-	-	NA	NA
Chloromethane	-	-	NA	NA
Dichloromethane	-	-	NA	NA
Trichlorofluoromethane	698	3490	NA	NA
Dichlorodifluoromethane	-	-	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number OW-112B

Parameter	Groundwater Standards, mg/l		Analytical Results, mg/l	
	PAL	ES	12/88	1/89
Indicators:				
COD	25	-	<5	<5
BOD	25	-	<3	<2
Boron	2	-	<0.05	0.16
Cond @ 25°	200	-	1642	1133
pH	+/-1	-	7.95	8.12
Hardness	100	-	775	600
Alkalinity	100	-	524	376
NH3-N	2	-	<0.1	<0.1
Public Health and Welfare:				
Chloride	125	250	226	23.5
Sulfates	125	250	201	226
Chromium	0.005	0.05	<0.002	<0.002
Mercury	0.0002	0.002	<0.0002	<0.0002
Lead	0.005	0.05	0.04	<0.002
Cadmium	0.001	0.01	<0.001	<0.001
Arsenic	0.005	0.05	<0.001	0.002
Dis Iron	0.15	0.3	1.87	0.87
NO ₂ +NO ₃ -N	2	10	<0.05	<0.05
Barium	0.2	1	0.24	0.18

Notes:

PAL - Denotes Preventive Action Limit (Increase above background)
ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number OW-112B

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l	
	PAL	ES	12/88	1/89
Methylene chloride	15	150	X	X
1,1 - Dichloroethylene	0.024	0.24	32	5
1,1 - Dichloroethane	85	850	50	15
Chloroform	-	-	X	X
Carbon tetrachloride	-	-	X	X
1,2 - Dichloropropane	-	-	X	X
Trichloroethylene (TCE)	0.18	1.8	26	209
1,1,2 - Trichloroethane	0.06	0.6	X	X
Dibromochloromethane	-	-	X	X
Tetrachloroethylene	0.1	1	X	X
Chlorobenzene	-	-	X	X
Trans-1,2-Dichloroethylene	20	100	21	2
1,2 - Dichloroethane	0.05	0.5	X	2
1,1,1 - Trichloroethane	40	200	X	X
Bromodichloromethane	-	-	X	X
Benzene	0.067	0.67	3	X
Bromoform	-	-	X	X
1,1,2,2-Tetrachloroethane	-	-	X	X
Toluene	68.6	343	X	X
Ethylbenzene	272	1360	X	X
Vinyl chloride	0.0015	0.015	22	X
Total xylene	124	620	X	X
1,2-Dichlorobenzene	125	1250	X	X
1,3-Dichlorobenzene	125	1250	X	X
1,4-Dichlorobenzene	150	750	X	X
2-Chloroethylvinyl Ether	-	-	X	X
Cis-1,2-Dichloroethylene	10	100	570	118
trans-1,3-dichloropropene	-	-	X	X
cis-1,3-dichloropropene	-	-	X	X
Total 1,2-Dichloroethylene	-	-	NA	NA
Bromomethane	-	-	NA	NA
Chloroethane	-	-	NA	NA
Chloromethane	-	-	NA	NA
Dichloroethane	-	-	NA	NA
Trichlorofluoromethane	698	3490	NA	NA
Dichlorodifluoromethane	-	-	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

**US Army Reserve 84th Division
Groundwater Sampling and Analysis**

Well Number P-112A

Parameter	Groundwater Standards, mg/l		Analytical Results, mg/l	
	PAL	ES	12/88	1/89
Indicators:				
COD	25	-	<5	<5
BOD	25	-	<3	<2
Boron	2	-	0.06	0.13
Cond @ 25°	200	-	1795	1563
pH	+/-1	-	7.63	8.43
Hardness	100	-	773	670
Alkalinity	100	-	524	382
NH3-N	2	-	<0.1	<0.1
Public Health and Welfare:				
Chloride	125	250	183	195
Sulfates	125	250	192	201
Chromium	0.005	0.05	<0.002	<0.002
Mercury	0.0002	0.002	<0.0002	<0.0002
Lead	0.005	0.05	0.033	<0.002
Cadmium	0.001	0.01	<0.001	<0.001
Arsenic	0.005	0.05	<0.001	0.001
Dis Iron	0.15	0.3	1.43	1.81
NO2+NO3-N	2	10	<0.05	<0.05
Barium	0.2	1	0.2	0.18

Notes:

PAL - Denotes Preventive Action Limit (Increase above background)
 ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number P-112A

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l	
	PAL	ES	12/88	1/89
Methylene chloride	15	150	X	X
1,1 - Dichloroethylene	0.024	0.24	30	46
1,1 - Dichloroethane	85	850	52	104
Chloroform	-	-	X	X
Carbon tetrachloride	-	-	X	X
1,2 - Dichloropropane	-	-	X	X
Trichloroethylene (TCE)	0.18	1.8	36	56
1,1,2 - Trichloroethane	0.06	0.6	X	X
Dibromo-chloromethane	-	-	X	X
Tetrachloroethylene	0.1	1	X	X
Chlorobenzene	-	-	X	X
Trans-1,2-Dichloroethylene	20	100	17	27
1,2 - Dichloroethane	0.05	0.5	X	22
1,1,1 - Trichloroethane	40	200	X	X
Bromodichloromethane	-	-	X	X
Benzene	0.067	0.67	3	4
Bromotorm	-	-	X	X
1,1,2,2-Tetrachloroethane	-	-	X	X
Toluene	68.6	343	X	X
Ethybenzene	272	1360	X	X
Vinyl chloride	0.0015	0.015	X	X
Total xylene	124	620	X	X
1,2-Dichlorobenzene	125	1250	X	X
1,3-Dichlorobenzene	125	1250	X	X
1,4-Dichlorobenzene	150	750	X	X
2-Chloroethylvinyl Ether	-	-	X	X
Cis-1,2-Dichloroethylene	10	100	587	762
trans-1,3-dichloropropene	-	-	X	X
cis-1,3-dichloropropene	-	-	X	X
Total 1,2-Dichloroethylene	-	-	NA	NA
Bromoethane	-	-	NA	NA
Chloroethane	-	-	NA	NA
Chloromethane	-	-	NA	NA
Dichloromethane	-	-	NA	NA
Trichlorofluoromethane	698	3490	NA	NA
Dichlorodifluoromethane	-	-	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number DW-113B

Parameter	Groundwater Standards, mg/l		Analytical Results, mg/l	
	PAL	ES	12/88	1/89
Indicators:				
COD	25	-	<5	<5
BOD	25	-	<2	<2
Boron	2	-	<0.05	<0.05
Cond @ 25°	200	-	1056	860
pH	+/-1	-	7.98	8.12
Hardness	100	-	503	478
Alkalinity	100	-	410	336
NH3-N	2	-	<0.01	0.12
Public Health and Welfare:				
Chloride	125	250	66.4	45.5
Sulfates	125	250	138	131
Chromium	0.005	0.05	<0.002	<0.002
Mercury	0.0002	0.002	<0.0002	<0.0002
Lead	0.005	0.05	0.019	<0.002
Cadmium	0.001	0.01	<0.001	<0.001
Arsenic	0.005	0.05	<0.001	0.002
Dis Iron	0.15	0.3	0.08	0.09
NO2+NO3-N	2	10	<0.05	<0.05
Barium	0.2	1	0.18	0.14

Notes:

PAL - Denotes Preventive Action Limit (Increase above background)
ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number OW-113B

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l	
	PAL	ES	12/88	1/89
Methylene chloride	15	150	X	3
1,1 - Dichloroethylene	0.024	0.24	X	X
1,1 - Dichloroethane	85	850	X	X
Chloroform	-	-	X	X
Carbon tetrachloride	-	-	X	X
1,2 - Dichloropropane	-	-	X	X
Trichloroethylene (TCE)	0.18	1.8	X	X
1,1,2 - Trichloroethane	0.06	0.6	X	X
Dibromochloromethane	-	-	X	X
Tetrachloroethylene	0.1	1	X	X
Chlorobenzene	-	-	X	X
Trans-1,2-Dichloroethylene	20	100	0.5	X
1,2 - Dichloroethane	0.05	0.5	X	X
1,1,1 - Trichloroethane	40	200	X	X
Bromodichloromethane	-	-	X	X
Benzene	0.067	0.67	X	X
Bromoform	-	-	X	X
1,1,2,2-Tetrachloroethane	-	-	X	X
Toluene	68.6	343	X	X
Ethylbenzene	272	1360	X	X
Vinyl Chloride	0.0015	0.015	X	X
Total xylene	124	620	X	X
1,2-Dichlorobenzene	125	1250	X	X
1,3-Dichlorobenzene	125	1250	X	X
1,4-Dichlorobenzene	150	750	X	X
2-Chloroethylvinyl Ether	-	-	X	X
Cis-1,2-Dichloroethylene	10	100	X	1.7
trans-1,3-dichloropropene	-	-	X	X
cis-1,3-dichloropropene	-	-	X	X
Total 1,2-Dichloroethylene	-	-	NA	NA
Bromomethane	-	-	NA	NA
Chloroethane	-	-	NA	NA
Chloromethane	-	-	NA	NA
Dichloromethane	-	-	NA	NA
Trichlorofluoromethane	698	3490	NA	NA
Dichlorodifluoromethane	-	-	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

**US Army Reserve 84th Division
Groundwater Sampling and Analysis**

Well Number P-113A

Parameter	Groundwater Standards, mg/l		Analytical Results, mg/l	
	PAL	ES	12/88	1/89
Indicators:				
COD	25	-	5	<5
BOD	25	-	<2	<2
Boron	2	-	<0.05	<0.05
Cond @ 25°	200	-	1096	1115
pH	+/-1	-	7.98	9.24
Hardness	100	-	510	634
Alkalinity	100	-	328	426
NH3-N	2	-	<0.1	0.12
Public Health and Welfare:				
Chloride	125	250	46	52.6
Sulfates	125	250	325	301
Chromium	0.005	0.05	<0.002	<0.002
Mercury	0.0002	0.002	<0.0002	<0.0002
Lead	0.005	0.05	0.031	<0.002
Cadmium	0.001	0.01	<0.001	<0.001
Arsenic	0.005	0.05	<0.001	0.001
Dis Iron	0.15	0.3	<0.05	<0.05
NO2+NO3-N	2	10	0.07	<0.05
Barium	0.2	1	0.24	0.22

Notes:

PAL - Denotes Preventive Action Limit (Increase above background
 ES - Denotes Enforcement Standard

US Army Reserve 84th Division
Groundwater Sampling and Analysis

Well Number P-113A

Volatile Organic Parameter	Groundwater Standards, ug/l		Analytical Results, ug/l	
	PAL	ES	12/88	1/89
Methylene chloride	15	150	X	1.5
1,1 - Dichloroethylene	0.024	0.24	X	X
1,1 - Dichloroethane	85	850	0.2	X
Chloroform	-	-	X	X
Carbon tetrachloride	-	-	X	X
1,2 - Dichloropropane	-	-	2	X
Trichloroethylene (TCE)	0.18	1.8	X	X
1,1,2 - Trichloroethane	0.06	0.6	2	X
Dibromochloromethane	-	-	3	X
Tetrachloroethylene	0.1	1	X	X
Chlorobenzene	-	-	X	X
Trans-1,2-Dichloroethylene	20	100	0.9	X
1,2 - Dichloroethane	0.05	0.5	X	X
1,1,1 - Trichloroethane	40	200	X	X
Bromodichloromethane	-	-	X	X
Benzene	0.067	0.67	X	X
Bromoform	-	-	4	X
1,1,2,2-Tetrachloroethane	-	-	X	X
Toluene	68.6	343	X	X
Ethylbenzene	272	1360	X	X
Vinyl chloride	0.0015	0.015	X	X
Total xylene	124	620	4	X
1,2-Dichlorobenzene	125	1250	15	X
1,3-Dichlorobenzene	125	1250	25	X
1,4-Dichlorobenzene	150	750	12	X
2-Chloroethylvinyl Ether	-	-	X	X
Cis-1,2-Dichloroethylene	10	100	X	10
trans-1,3-dichloropropene	-	-	1	X
cis-1,3-dichloropropene	-	-	2	X
Total 1,2-Dichloroethylene	-	-	NA	NA
Bromomethane	-	-	NA	NA
Chloroethane	-	-	NA	NA
Chloromethane	-	-	NA	NA
Dichloromethane	-	-	NA	NA
Trichlorofluoromethane	698	3490	NA	NA
Dichlorodifluoromethane	-	-	NA	NA

X - Analyzed for but not detected

NA - Not analyzed

PAL - Denotes Preventive Action Limit

ES - Denotes Enforcement Standard

Donohue

QUALITY CONTROL REPORT

U.S. Army Reserve 34th Division
(Samples 56844-56853, 56870 Analyzed 1/31/89)
(Samples 56871-56876 Analyzed 2/1/89)

SURROGATE RECOVERIES

<u>Sample</u>	<u>% Recovery</u> Trifluorotoluene	<u>% Recovery</u> 1,4-Dichlorobutane
56844	101	91
56845	101	116
56846	83	114
56847		139
56848	79	116
56849	88	111
56850	89	112
56851	101	113
56852	97	114
56853	92	114
56870	81	114
56871	125	131
56872		121
56873	87	107
56874	108	104
56875	88	103
56876	96	109
Blank	98	114
Spiked Blank	80	116
Spiked Blank	96	113

Spike Recoveries

<u>Compound</u>	<u>% Recovery</u> Spike 1	<u>% Recovery</u> Spike 2
1,1,1-Trichloroethane	112	96
Carbontetrachloride	94	79
Benzene	144	123
1,2-Dichloroethane	105	98
Trichloroethylene	141	138
1,4-Dichlorobenzene	145	168

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Inorganics
(Samples 56870-56875)

<u>Analyte</u>	<u>Duplicate % RPD</u>	<u>Sample Spike % Recovery</u>	<u>Spike Blank % Recovery</u>	<u>External QC % Recovery</u>
BOD	12	NA	100	103
COD	4	109	90	97
Ammonia Nitrogen	0	104	102	109
Nitrate + Nitrite	0	94	97	103
Arsenic	12	98	104	98
Barium	0	96	105	103
Boron	0	104	102	NA
Cadmium	0	91	104	83
Chromium	10	115	93	102
Iron	1	102	97	103
Lead	6	100	102	100
Mercury	1	81	60	83
Alkalinity	2	95	98	92
Chloride	0	100	96	99
Sulfate	2	111	104	106
Hardness	4	111	92	102

Analyses performed in accordance with
procedures approved by the U.S. EPA.

Greg Ruechel
QC Coordinator

3/10/89
Date

Donohue

QUALITY CONTROL REPORT

U.S. Army Reserve 84th Division
(Samples 56004-56012, Analyzed 1/3/89)
(Samples 56046-56052 Analyzed 1/4/89)

SURROGATE RECOVERIES

<u>Sample</u>	<u>% Recovery</u> Trifluorotoluene	<u>% Recovery</u> 1,4-Dichlorobutane
56004	97	115
56005	109	130
56006	108	135
56007	103	125
56008	108	125
56009	102	125
56010	100	126
56011	105	120
56012	103	125
Blank	96	150
56046	107	100
56047	105	135
56048	107	110
56049	115	90
56050	109	90
56051	101	95
56052	102	95
Blank	81	135

Donohue Analytical
4738 North 40th Street
Sheboygan, Wisconsin 53083

Analytical & Field Services
414-458-8711

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Inorganics
(Samples 56046-56051)

<u>Analyte</u>	<u>Duplicate % RPD</u>	<u>Sample Spike % Recovery</u>	<u>Spike Blank % Recovery</u>	<u>External QC % Recovery</u>
BOD	4	NA	94	102
COD	0	102	105	104
Ammonia Nitrogen	0	96	90	95
Nitrate + Nitrite	0	94	103	102
Arsenic	0	90	96	97
Barium	13	114	106	88
Boron	0	106	110	NA
Cadmium	0	81	98	113
Chromium	0	78	101	100
Iron	4	106	122	115
Lead	0	118	96	95
Mercury	0	108	103	82
Alkalinity	3	106	92	89
Chloride	1	93	95	100
Sulfate	0	103	106	100
Hardness	0	106	98	95

Analyses performed in accordance with
procedures approved by the U.S. EPA.

Xug Ruchel
QC Coordinator

3/10/89
Date

Donohue

US Army Res. 84th Division

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 12-21-88

NO. 56007 DESCRIPTION OW101B

TAKEN 12-21-88

Color	Clear	
Odor	Yes; sulfur	
Turbidity	No	NTU
pH - Field	7.45	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	1	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	49	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

Analyses performed in accordance with
procedures approved by the U.S. EPA.
Certified by the State of Wisconsin DNR
Laboratory I.D. No. 460060920

Donohue Analytical
4738 North 40th Street
Sheboygan, Wisconsin 53083

Analytical & Field Services
414-458-8711

-----*Keeny - J. Keyes*-----
Project Manager
Date 1-5-02

Donohue

US Army Res. 84th Division

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 12-21-88

NO. 56006 DESCRIPTION P101A

TAKEN 12-21-88

Color	Clear	
Odor	No	
Turbidity	No	NTU
pH - Field	7.77	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	<0.5	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

Analyses performed in accordance with
procedures approved by the U.S. EPA.
Certified by the State of Wisconsin DNF
Laboratory I.D. No. 460060920

Donohue Analytical
4738 North 40th Street
Sheboygan, Wisconsin 53083

Analytical & Field Services
414-458-8711

Kerry DeKeyser
Project Manager
----- 1-5-89
Date

Donohue

US Army Res. 84th Division

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 12-21-88

NO. 56005 DESCRIPTION OW102B

TAKEN 12-21-88

Color	Clear	
Odor	No	
Turbidity	No	NTU
pH - Field	7.80	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	1	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	0.6	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<1	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	11	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

Analyses performed in accordance with
procedures approved by the U.S. EPA.
Certified by the State of Wisconsin DNR
Laboratory I.D. No. 460060920

Donohue Analytical
4738 North 40th Street
Sheboygan, Wisconsin 53083

Analytical & Field Services
414-458-8711

James J. Keyes 15-10-88
Project Manager Date

Donohue

US Army Res. 84th Division

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 12-21-88

NO. 56004 DESCRIPTION P102A

TAKEN 12-21-88

Color	Light gray	
Odor	No	
Turbidity	Yes	NTU
pH - Field	7.86	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	2	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	3	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<1	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	5	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	5	ug/l
1,2-Dichlorobenzene	10	ug/l
1,3-Dichlorobenzene	15	ug/l
1,4-Dichlorobenzene	8	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	8	ug/l
trans-1,3-dichloropropene	1	ug/l
cis-1,3-dichloropropene	3	ug/l

Analyses performed in accordance with
procedures approved by the U.S. EPA.
Certified by the State of Wisconsin DNR
Laboratory I.D. No. 460060920

Donohue Analytical
4738 North 40th Street
Sheboygan, Wisconsin 53083

Analytical & Field Services
414-458-8711

Project Manager

1-5-89
Date

Donohue

US Army Res. 84th Division

ATTN: Mr. Dave Voight.

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 12-21-88

NO. 56011 DESCRIPTION OW105B

TAKEN 12-21-88

Color	Clear	
Odor	No	
Turbidity	No	NTU
pH - Field	7.76	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	<0.5	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

Analyses performed in accordance with
procedures approved by the U.S. EPA.
Certified by the State of Wisconsin DNR
Laboratory I.D. No. 460060920

Donohue Analytical
4738 North 40th Street
Sheboygan, Wisconsin 53083

Analytical & Field Services
414-458-8711

Project Manager

Date

Kerry Rekeyser 12-21-88

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56049
DESCRIPTION: P112A

Total BOD5	<3	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	<1	ug/l
Barium	200	ug/l
Boron	60	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	1,430	ug/l
Lead	33	ug/l
Mercury	<0.2	ug/l
Alkalinity	524	mg/l
Total Hardness	773	mg/l
Chloride	183	mg/l
Sulfate	192	mg/l
Color	Clear	
Odor	No	
Turbidity	No	NTU
Specific Conductance-Field	1,795	umhos/cm
pH - Field	7.63	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	30	ug/l
1,1 - Dichloroethane	52	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	36	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	17	ug/l
1,2 - Dichloroethane	<1	ug/l

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Sheboygan, Wisconsin 53083

Analytical & Field Services
414-458-8711

Analyses performed in accordance with
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Certified by the State of Wisconsin DN
Laboratory I.D. No. 460060920

Project Manager

1-18-87
Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56049
DESCRIPTION: P112A

1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	3	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	587	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l
Temperature	48 degrees	F

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Laboratory I.D. No. 460060920

Kerry L. Keyes 1-18-89
Project Manager Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56047
DESCRIPTION: OWL13B

Total BOD5	<2	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	<1	ug/l
Barium	180	ug/l
Boron	<50	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	80	ug/l
Lead	19	ug/l
Mercury	<0.2	ug/l
Alkalinity	410	mg/l
Total Hardness	503	mg/l
Chloride	66.4	mg/l
Sulfate	138	mg/l
Color	Gray silty	
Odor	No	
Turbidity	Yes	NTU
Specific Conductance-Field	1,056	umhos/cm
pH - Field	7.98	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	0.5	ug/l
1,2 - Dichloroethane	<1	ug/l

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Laboratory I.D. No. 460060920

Project Manager

1/18/89
Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56047
DESCRIPTION: OW113B

1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethyl vinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	<0.5	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l
Temperature	48 degrees	F

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Laboratory I.D. No. 460060920

Kerry DeKeyser

Project Manager
Date 1-12-89

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56046

DESCRIPTION: PII3A

Total BOD5	<2	mg/l
Total COD	5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	0.07	mg/l
Arsenic	<1	ug/l
Barium	240	ug/l
Boron	<50	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	<50	ug/l
Lead	31	ug/l
Mercury	<0.2	ug/l
Alkalinity	328	mg/l
Total Hardness	510	mg/l
Chloride	46.0	mg/l
Sulfate	325	mg/l
Color	Gray	
Odor	No	
Turbidity	Yes	NTU
Specific Conductance-Field	1,096	umhos/cm
pH - Field	7.98	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	0.2	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	2	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	2	ug/l
Dibromochloromethane	3	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	0.9	ug/l
1,2 - Dichloroethane	<1	ug/l

Analyses performed in accordance with
procedures approved by the U.S. EPA.
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Laboratory I.D. No. 460060920

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4738 North 40th Street
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Analytical & Field Services
414-458-8711

-- *Kerry L. Kuder* -- Project Manager

1-18-82

Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56049
DESCRIPTION: P112A

Total BOD5	<3	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	<1	ug/l
Barium	200	ug/l
Boron	60	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	1,430	ug/l
Lead	33	ug/l
Mercury	<0.2	ug/l
Alkalinity	524	mg/l
Total Hardness	773	mg/l
Chloride	183	mg/l
Sulfate	192	mg/l
Color	Clear	
Odor	No	
Turbidity	No	NTU
Specific Conductance-Field	1,795	umhos/cm
pH - Field	7.63	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	30	ug/l
1,1 - Dichloroethane	52	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	36	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	17	ug/l
1,2 - Dichloroethane	<1	ug/l

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Certified by the State of Wisconsin DR
Laboratory I.D. No. 460060920

Project Manager

178-87
Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56049
DESCRIPTION: P112A

1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	3	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	587	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l
Temperature	48 degrees	F

Donohue Analytical
4738 North 40th Street
Sheboygan, Wisconsin 53083

Analytical & Field Services
414-458-8711

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Certified by the State of Wisconsin DN
Laboratory I.D. No. 460060920

Kerry Hayes
Project Manager 1/18/89
Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56047
DESCRIPTION: OW113B

Total BOD5	<2	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	<1	ug/l
Barium	180	ug/l
Boron	<50	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	80	ug/l
Lead	19	ug/l
Mercury	<0.2	ug/l
Alkalinity	410	mg/l
Total Hardness	503	mg/l
Chloride	66.4	mg/l
Sulfate	138	mg/l
Color	Gray silty	
Odor	No	
Turbidity	Yes	NTU
Specific Conductance-Field	1,056	umhos/cm
pH - Field	7.98	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	0.5	ug/l
1,2 - Dichloroethane	<1	ug/l

Analyses performed in accordance with
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Laboratory I.D. No. 460060920

Donohue Analytical
4738 North 40th Street
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Analytical & Field Services
414-458-8711

Project Manager

1/8-89
Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56047
DESCRIPTION: OW113B

1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethyl-Vinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	<0.5	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l
Temperature	48 degrees	F

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4738 North 40th Street
Sheboygan, Wisconsin 53083

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414-458-8711

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Certified by the State of Wisconsin DN
Laboratory I.D. No. 460060920

Kerry A. Keayes
Project Manager

1-12-89
Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56046
DESCRIPTION: Pl13A

Total BOD5	<2	mg/l
Total COD	5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	0.07	mg/l
Arsenic	<1	ug/l
Barium	240	ug/l
Boron	<50	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	<50	ug/l
Lead	31	ug/l
Mercury	<0.2	ug/l
Alkalinity	328	mg/l
Total Hardness	510	mg/l
Chloride	46.0	mg/l
Sulfate	325	mg/l
Color	Gray	
Odor	No	NTU
Turbidity	Yes	umhos/cm
Specific Conductance-Field	1,096	units
pH - Field	7.98	
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	0.2	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	2	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	2	ug/l
Dibromochloromethane	3	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	0.9	ug/l
1,2 - Dichloroethane	<1	ug/l

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4738 North 40th Street
Sheboygan, Wisconsin 53083

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Certified by the State of Wisconsin DN
Laboratory I.D. No. 460060920

-- *Kerry Schaefer* -- 1-28-89
Project Manager Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56046
DESCRIPTION: P113A

1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	4	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	4	ug/l
1,2-Dichlorobenzene	15	ug/l
1,3-Dichlorobenzene	25	ug/l
1,4-Dichlorobenzene	12	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	<0.5	ug/l
trans-1,3-dichloropropene	1	ug/l
cis-1,3-dichloropropene	2	ug/l
Temperature	48 degrees	F

Donohue Analytical
4738 North 40th Street
Sheboygan, Wisconsin 53083

Analytical & Field Services
414-458-8711

Analyses performed in accordance with
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Certified by the State of Wisconsin DR.
Laboratory I.D. No. 460060920

Project Manager

1-18-89
Date

Donohue

US Army Res. 84th Division

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 12-21-88

NO. 56012 DESCRIPTION Field Blank

TAKEN 12-21-88

Color	NA	
Odor	NA	
Turbidity	NA	NTU
pH - Field	NA	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	<0.5	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

Analyses performed in accordance with
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Donohue Analytical
4738 North 40th Street
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Analytical & Field Services
414-458-8711

Project Manager

1-5-89
Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56048
DESCRIPTION: 114A

Total BOD5	<2	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	1	ug/l
Barium	150	ug/l
Boron	<50	ug/l
Cadmium	.1	ug/l
Chromium	<2	ug/l
Iron	<50	ug/l
Lead	19	ug/l
Mercury	<0.2	ug/l
Alkalinity	450	mg/l
Total Hardness	500	mg/l
Chloride	67.6	mg/l
Sulfate	136	mg/l
Color	Gray silty	
Odor	No	
Turbidity	Yes	NTU
Specific Conductance-Field	1,056	umhos/cm
pH - Field	7.98	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<1	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l

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Sheboygan, Wisconsin 53083

Analytical & Field Services
414-458-8711

Analyses performed in accordance with
procedures approved by the U.S. EPA.
Certified by the State of Wisconsin Di
Laboratory I.D. No. 460060920

---*Keely Hayes*--- 128-89
Project Manager Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56048
DESCRIPTION: 114A

1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	<0.5	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l
Temperature	48 degrees	F

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4738 North 40th Street
Sheboygan, Wisconsin 53083

Analytical & Field Services
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Laboratory I.D. No. 460060920

Kerry DeKeyser
Project Manager

1-8-82
Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56051
DESCRIPTION: Field Blank

Total BOD5	2	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	<1	ug/l
Barium	<100	ug/l
Boron	<50	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	60	ug/l
Lead	<2	ug/l
Mercury	<0.2	ug/l
Alkalinity	<5.0	mg/l
Total Hardness	<5.0	mg/l
Chloride	<0.50	mg/l
Sulfate	<2.0	mg/l
Color	NA	
Odor	NA	
Turbidity	NA	NTU
Specific Conductance-Field	NA	umhos/cm
pH - Field	NA	units
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<1	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	0.8	ug/l
1,2 - Dichloroethane	<1	ug/l

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Analytical & Field Services
414-458-8711

Kerry L. Keyser 1-18-89
Project Manager Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56051
DESCRIPTION: Field Blank

1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethyl vinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	7	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l
Temperature	NA	F

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Laboratory I.D. No. 460060920

-----*Kerry L. Keayser*----- 1-18-89
Project Manager Date

Donohue

US Army Reserve 84th Div.

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 12-22-88
SAMPLE RECEIVED: 12-22-88

SAMPLE NO: 56052
DESCRIPTION: Trip Blank

Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<1	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	<0.5	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Laboratory I.D. No. 460060920

Kerry A. Keyser 1-2-82
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 01-23-89

). 56845 DESCRIPTION OW101B

TAKEN 01-23-89

Methylene chloride	2	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	3	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	86	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Certified by the State of Wisconsin DNR
Laboratory I.D. No. 460060920

Donohue Analytical
4738 North 40th Street
Sheboygan, Wisconsin 53083

Analytical & Field Services
414-458-8711

Project Manager

Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 01-23-89

). 56844 DESCRIPTION P101A

TAKEN 01-23-89

Methylene chloride	6	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	2	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	3	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	<0.5	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Laboratory, I.D. No. 460060920

Project Manager

2-6-89
Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 01-23-89

NO. 56846 DESCRIPTION OW102B

TAKEN 01-23-89

Methylene chloride	3	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	3	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	16	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Laboratory I.D. No. 460060920

--Kesey--Kesey-- 2-6-89
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 01-23-89

NO.	DESCRIPTION	P102A	TAKEN 01-23-89
	Methylene chloride	10	ug/l
	1,1 - Dichloroethylene	<1	ug/l
	1,1 - Dichloroethane	7	ug/l
	Chloroform	<1	ug/l
	Carbon tetrachloride	<1	ug/l
	1,2 - Dichloropropane	<1	ug/l
	Trichloroethylene (TCE)	8	ug/l
	1,1,2 - Trichloroethane	5	ug/l
	Dibromochloromethane	2	ug/l
	Tetrachloroethylene	<1	ug/l
	Chlorobenzene	3	ug/l
	Trans-1,2-Dichloroethylene	<0.5	ug/l
	1,2 - Dichloroethane	5	ug/l
	1,1,1 - Trichloroethane	<1	ug/l
	Bromodichloromethane	5	ug/l
	Benzene	<1	ug/l
	Bromoform	<1	ug/l
	1,1,2,2-Tetrachloroethane	<1	ug/l
	Toluene	<1	ug/l
	Ethylbenzene	<1	ug/l
	Vinyl chloride	<2	ug/l
	Total Xylene	5	ug/l
	1,2-Dichlorobenzene	18	ug/l
	1,3-Dichlorobenzene	14	ug/l
	1,4-Dichlorobenzene	14	ug/l
	2-Chloroethylvinyl Ether	<1	ug/l
	Cis-1,2-Dichloroethylene	30	ug/l
	trans-1,3-dichloropropene	<1	ug/l
	cis-1,3-dichloropropene	<1	ug/l

Donohue Analytical
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Sheboygan, Wisconsin 53083

Analytical & Field Services
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Laboratory I.D. No. 460060920

--Kerry A. Leyes-- 2-6-78
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 01-23-89

NO.	DESCRIPTION	TAKEN 01-23-89
	Methylene chloride	7 ug/l
	1,1 - Dichloroethylene	<1 ug/l
	1,1 - Dichloroethane	4.8 ug/l
	Chloroform	<1 ug/l
	Carbon tetrachloride	3 ug/l
	1,2 - Dichloropropane	<1 ug/l
	Trichloroethylene (TCE)	3.1 ug/l
	1,1,2 - Trichloroethane	3 ug/l
	Dibromochloromethane	<1 ug/l
	Tetrachloroethylene	2 ug/l
	Chlorobenzene	2 ug/l
	Trans-1,2-Dichloroethylene	2.4 ug/l
	1,2 - Dichloroethane	6 ug/l
	1,1,1 - Trichloroethane	6 ug/l
	Bromodichloromethane	2 ug/l
	Benzene	<1 ug/l
	Bromoform	<1 ug/l
	1,1,2,2-Tetrachloroethane	<1 ug/l
	Toluene	<1 ug/l
	Ethylbenzene	<1 ug/l
	Vinyl chloride	<2 ug/l
	Total Xylene	3 ug/l
	1,2-Dichlorobenzene	6 ug/l
	1,3-Dichlorobenzene	5 ug/l
	1,4-Dichlorobenzene	3 ug/l
	2-Chloroethylvinyl Ether	<1 ug/l
	Cis-1,2-Dichloroethylene	6.6 ug/l
	trans-1,3-dichloropropene	<1 ug/l
	cis-1,3-dichloropropene	<1 ug/l

Donohue Analytical
4738 North 40th Street
Sheboygan, Wisconsin 53083

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Laboratory I.D. No. 460060920

Kerry DePuyer
Project Manager

2-6-89
Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 01-23-89

NO. 56851 DESCRIPTION P105A

TAKEN 01-23-89

Methylene chloride	2	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	1.2	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	0.5	ug/l
1,2 - Dichloroethane	4	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	6	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	4	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	20	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

Donohue Analytical
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Analytical & Field Services
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Laboratory I.D. No. 460060920

Kelly Sheyser 2-6-22
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 01-23-89

NO. 56849 DESCRIPTION OW106B

TAKEN 01-23-89

Methylene chloride	5	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	0.9	ug/l
Chloroform	3	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	0.7	ug/l
1,1,2 - Trichloroethane	3	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	2	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	2	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	10	ug/l
1,3-Dichlorobenzene	8	ug/l
1,4-Dichlorobenzene	8	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	4	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Laboratory I.D. No. 460060920

Kerry M. Kuyper 2-6-89
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 01-23-89

NO. 56848 DESCRIPTION P106A TAKEN 01-23-89

Methylene chloride	9	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	2	ug/l
Chloroform	5	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	6	ug/l
Dibromochloromethane	3	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	2	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	5	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	4	ug/l
Benzene	<1	ug/l
Bromoform	2	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	4	ug/l
1,2-Dichlorobenzene	17	ug/l
1,3-Dichlorobenzene	12	ug/l
1,4-Dichlorobenzene	12	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	10	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Sheboygan, Wisconsin 53083

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414-458-8711

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Laboratory I.D. No. 460060920

Project Manager

2-6-89
Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56874
DESCRIPTION: OW112B

Total BOD5	<2	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	2	ug/l
Barium	180	ug/l
Boron	160	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	870	ug/l
Lead	<2	ug/l
Mercury	<0.2	ug/l
Alkalinity	376	mg/l
Total Hardness	600	mg/l
Chloride	23.5	mg/l
Sulfate	226	mg/l
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	5	ug/l
1,1 - Dichloroethane	15	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	209	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	2.0	ug/l
1,2 - Dichloroethane	2	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l

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414-458-8711

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Laboratory I.D. No. 460060920

Kelly L. Kuehne
Project Manager
Date 2-14-89

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56874
DESCRIPTION: OW112B

Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	118	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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--*Kerry L. Voight*-- 2/14/89
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56872
DESCRIPTION: P112A

Total BOD5	<2	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	1	ug/l
Barium	180	ug/l
Boron	130	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	1,810	ug/l
Lead	<2	ug/l
Mercury	<0.2	ug/l
Alkalinity	382	mg/l
Total Hardness	670	mg/l
Chloride	195	mg/l
Sulfate	201	mg/l
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	46	ug/l
1,1 - Dichloroethane	104	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	56	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	27	ug/l
1,2 - Dichloroethane	22	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	4	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l

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Kelly Keyser ----- 2-14-89
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56872
DESCRIPTION: P112A

Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	762	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Laboratory I.D.. No. 460060920

Project Manager

2-14-89
Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56871
DESCRIPTION: OW113B

Total BOD ₅	<2	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	0.12	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	2	ug/l
Barium	140	ug/l
Boron	<50	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	90	ug/l
Lead	<2	ug/l
Mercury	<0.2	ug/l
Alkalinity	336	mg/l
Total Hardness	478	mg/l
Chloride	45.5	mg/l
Sulfate	131	mg/l
Methylene chloride	3	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l

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Kerry L. Keyes
Project Manager Date
2-14-89

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56871
DESCRIPTION: OW113B

Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	1.7	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Kerry Ahrens
Project Manager Date
2-14-89

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56870
DESCRIPTION: P113A

Total BOD5	<2	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	0.12	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	1	ug/l
Barium	220	ug/l
Boron	<50	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	<50	ug/l
Lead	<2	ug/l
Mercury	<0.2	ug/l
Alkalinity	426	mg/l
Total Hardness	634	mg/l
Chloride	52.6	mg/l
Sulfate	301	mg/l
Methylene chloride	1.5	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l

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Laboratory I.D. No. 460060920

*-----
Kerry A. Klyses-----
Project Manager* *2-14-89
Date*

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56870
DESCRIPTION: P113A

Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	10	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Kerry Schreyer 2-14-82
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 01-23-89

NO. 56852 DESCRIPTION Field Blank

TAKEN 01-23-89

Methylene chloride	6	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	1.1	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	0.6	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Analytical & Field Services
414-458-8711

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Laboratory I.D. No. 460060920

Kerry DeKeyser 2-6-89
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: SEE BELOW
SAMPLE RECEIVED: 01-23-89

NO.	DESCRIPTION	Trip Blank	TAKEN 01-23-89
	Methylene chloride	43	ug/l
	1,1 - Dichloroethylene	<1	ug/l
	1,1 - Dichloroethane	<0.5	ug/l
	Chloroform	4	ug/l
	Carbon tetrachloride	<1	ug/l
	1,2 - Dichloropropane	<1	ug/l
	Trichloroethylene (TCE)	<0.5	ug/l
	1,1,2 - Trichloroethane	<1	ug/l
	Dibromochloromethane	<1	ug/l
	Tetrachloroethylene	<1	ug/l
	Chlorobenzene	<1	ug/l
	Trans-1,2-Dichloroethylene	<0.5	ug/l
	1,2 - Dichloroethane	1.3	ug/l
	1,1,1 - Trichloroethane	<1	ug/l
	Bromodichloromethane	<1	ug/l
	Benzene	<1	ug/l
	Bromoform	<1	ug/l
	1,1,2,2-Tetrachloroethane	<1	ug/l
	Toluene	<1	ug/l
	Ethylbenzene	<1	ug/l
	Vinyl chloride	<2	ug/l
	Total Xylene	<2	ug/l
	1,2-Dichlorobenzene	<1	ug/l
	1,3-Dichlorobenzene	<1	ug/l
	1,4-Dichlorobenzene	3	ug/l
	2-Chloroethylvinyl Ether	<1	ug/l
	Cis-1,2-Dichloroethylene	<0.5	ug/l
	trans-1,3-dichloropropene	<1	ug/l
	cis-1,3-dichloropropene	<1	ug/l

Donohue Analytical
4738 North 40th Street
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Analytical & Field Services
414-458-8711

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Laboratory I.D. No. 460060920

Kerry L. Keyes 2-6-89
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56873
DESCRIPTION: P122B

Total BOD5	<2	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	<1	ug/l
Barium	160	ug/l
Boron	220	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	1,810	ug/l
Lead	<2	ug/l
Mercury	<0.2	ug/l
Alkalinity	388	mg/l
Total Hardness	688	mg/l
Chloride	231	mg/l
Sulfate	181	mg/l
Methylene chloride	<1	ug/l
1,1 - Dichloroethylene	20	ug/l
1,1 - Dichloroethane	38	ug/l
Chloroform	23	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	28	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	12.2	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	2	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l

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-----*Ken Cleary*-----
Project Manager

2-14-85
Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: .56873
DESCRIPTION: P122B

Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	422	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Kelly O'Leary
Project Manager

2-14-89
Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56875
DESCRIPTION: Field Blank

Total BOD5	<2	mg/l
Total COD	<5	mg/l
Ammonia Nitrogen	<0.1	mg/l
Nitrate+Nitrite Nitrogen	<0.05	mg/l
Arsenic	<1	ug/l
Barium	<100	ug/l
Boron	<50	ug/l
Cadmium	<1	ug/l
Chromium	<2	ug/l
Iron	<50	ug/l
Lead	<2	ug/l
Mercury	<0.2	ug/l
Alkalinity	<10.0	mg/l
Total Hardness	<5.0	mg/l
Chloride	<0.50	mg/l
Sulfate	<2.0	mg/l
Methylene chloride	5	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l

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Analytical & Field Services
414-458-8711

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Laboratory I.D. No. 460060920

--Kerry O'Key----- 2-14-89
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56875
DESCRIPTION: Field Blank

Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	<0.5	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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Laboratory I.D. No. 460060920

Kerry deKeyser 2-14-89
Project Manager Date

Donohue

U.S. Army Reserve

ATTN: Mr. Dave Voight

PROJECT NUMBER: 15977.007
COLLECTION DATA: Collected by Donohue
SAMPLE COLLECTED: 01-24-89
SAMPLE RECEIVED: 01-24-89

SAMPLE NO: 56876
DESCRIPTION: Trip Blank

Methylene chloride	6	ug/l
1,1 - Dichloroethylene	<1	ug/l
1,1 - Dichloroethane	<0.5	ug/l
Chloroform	<1	ug/l
Carbon tetrachloride	<1	ug/l
1,2 - Dichloropropane	<1	ug/l
Trichloroethylene (TCE)	<0.5	ug/l
1,1,2 - Trichloroethane	<1	ug/l
Dibromochloromethane	<1	ug/l
Tetrachloroethylene	<1	ug/l
Chlorobenzene	<1	ug/l
Trans-1,2-Dichloroethylene	<0.5	ug/l
1,2 - Dichloroethane	<1	ug/l
1,1,1 - Trichloroethane	<1	ug/l
Bromodichloromethane	<1	ug/l
Benzene	<1	ug/l
Bromoform	<1	ug/l
1,1,2,2-Tetrachloroethane	<1	ug/l
Toluene	<1	ug/l
Ethylbenzene	<1	ug/l
Vinyl chloride	<2	ug/l
Total Xylene	<2	ug/l
1,2-Dichlorobenzene	<1	ug/l
1,3-Dichlorobenzene	<1	ug/l
1,4-Dichlorobenzene	<1	ug/l
2-Chloroethylvinyl Ether	<1	ug/l
Cis-1,2-Dichloroethylene	<0.5	ug/l
trans-1,3-dichloropropene	<1	ug/l
cis-1,3-dichloropropene	<1	ug/l

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4738 North 40th Street
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Analytical & Field Services
414-458-8711

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Laboratory I.D. No. 460060920

Project Manager *Kerry L. Keyser* Date *2/25/90*

APPENDIX G

**WISCONSIN DNR GROUNDWATER MONITORING
WELL INSTALLATION FORM**

Facility Name U.S. Army Reserve Complex Milwaukee	Facility ID Number	Date 3/9/89	Completed By (Name and Firm)			Reference Source	Type of Well (-)					
			Well ID Number DNW No.	Well Location N S E W	Date Established			Diam. Type	Top of Well Casing	Ground Surface	Screen Top	MSL Datum (-)
OH-112B	418017.3 X	11/17/88	2"	P	691.36	691.54	677.65	X	10.0'	PVC	23.71	X
P-112A	2539210.0 X	11/23/88	2"	P	691.22	691.76	653.03	X	5.0'	PVC	43.19	X
OH-113B	415877.9 X	11/15/88	2"	P	682.94	679.44	672.60	X	10.1'	PVC	20.64	X
P-113A	2539068.3 X	11/16/88	2"	P	682.98	679.90	640.38	X	5.0	PVC	47.60	X

Received by: _____
District: _____ Area: _____ Bureau: _____
File Maint. Completed: _____ Date: _____
Other: _____

SMS Use: _____

Facilities Coordinates Arc:
 Grid System State Plane Coordinate
 Northern Central
 Southern